ACORN USER

BBC micro, Electron and Atom magazine

July 1983 £1

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BBC: numeric keypad

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JULY 1983
NUMBER TWELVE

How to submit articles: You are welcome to send articles to the Editor of *Acorn User* for publication. *Acorn User* cannot undertake to return them unless a stamped addressed envelope is enclosed. Articles should be typed or computer written with double line spacing. Black and white photographs or transparencies are also appreciated. If submitting programs a cassette or disc is vital. Payment is £50 per page or pro rata. Please indicate if you have submitted your article elsewhere. Send articles, reviews and information to: The Editor, *Acorn User*, 53 Bedford Square, London WC1B 3DZ.

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CONTENTS



Cover design: Phil Kanssen
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The first colour picture of the Electron — see page 5

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EDITORIAL

WELL, you've stuck with Acorn User for a year and we're glad to see you're still here. If you're reading us for the first time, we hope you'll be here this time next year.

Launching this magazine into what was originally a vacuum of information on the BBC micro hasn't been easy, but the response has been amazing, overwhelming and rewarding for the editorial staff (all two of us).

The birth of the BBC micro system, and now the Electron, has been a saga-and-a-half, but there's nothing new about that in the micro world. *Acorn User* is here to help with advice and articles. But when it comes down to it Acorn users really support themselves and each other. This magazine is just a good way of doing it, after all, it's written for users, by users.

So thanks for reading, and for your patience when we get it wrong. See you in August.

Tony Quinn
Kitty Milne

Coming soon in *Acorn User:*
Electron: the best review by the best people
Projects: all the fun of the fair
Printers: agony uncle George Hill answers your question
Graphics: simple listings
Telesoftware: how it all works
Reviews: interfacing equipment
Colour filling: includes 1.2 plotting
Techniques: linked lists

Authors please note

We've been inundated with articles for publication – many of an extremely high standard. It takes time to read them, try listings out and edit them – which is the only way to maintain standards. Also please remember that magazines work at least two months in advance.

So please bear with us if you hear nothing for weeks (although all submissions are acknowledged).

Thanks for your patience and apologies for any frustration caused.

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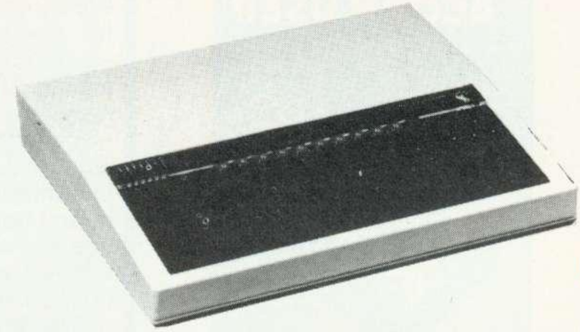
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Like gold dust – the machine everyone's talking about, set for an August launch

Electron set for battle at £199

THE Electron should be in the shops by the end of August – and it will cost £199.

Acorn has been keeping the launch date and price a close secret because of expected reductions by competitors.

Joint Acorn boss Chris Curry explained: 'The Electron is aimed at the Spectrum, Oric and Dragon market and it will have a massive impact on sales of these machines.'

The Acorn bosses clearly expect a battle. On the recent Sinclair price-cutting he said: 'We anticipated this price decrease.

'We originally told people the Electron launch would be in March or April, and the Sinclair move was more than a coincidence. The Electron's performance is so much better.'

And Curry seemed unworried by rumours of a Sinclair ZX83. 'I'm waiting for my spies to report,' he said!

The Electron will go out to dealers and High Street chains. Projected sales are 100,000 by Christmas with W.H. Smith's selling the machine, Boots a second likely outlet, and talks underway with others.

But Curry did not expect sales of the BBC machine to be affected: 'When it's expanded, the Electron costs more than the BBC machine.

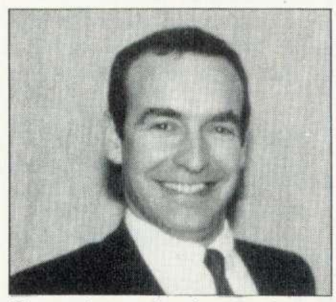
'We hope it will carry the (BBC Basic) language to a larger section of the population. It will be used as a second computer at home by children using the BBC at school.'

Curry saw this as an extension to the BBC's Computer Literacy Scheme: 'The BBC is happy,' he said, 'because they see it as support for the language, making it as standard as possible.'

The model A will be phased out however. Acorn will no longer promote it, said Curry, and the great majority of orders were for the model B.

As for the Atom, Acorn has nothing in the pipeline (their last product was the BBC Basic board). However, the company will continue to support and sell the Atom.

The first add-on for the Electron (nicknamed 'The Elk' at Acorn), will be a general-purpose module comprising: printer interface, sideways ROM extension (to take six), games paddle sockets, and RS232.



Curry: 'massive impact'

Great efforts are being made to get the module out for the launch, but this seems unlikely, and a price has not yet been fixed.

Subscribers vouchers in next issue

SUBSCRIBERS will receive their £1 voucher towards entrance to the Acorn User Exhibition in the next issue.

The August issue will also give news of exhibitors and details of the special attractions being prepared.

And while some may hint at availability of second processors, Electrons, and the like, we know they'll be ready for the Acorn User Exhibition.

As we explain above, the end of August is the official Electron launch date, with two of the three second processors appearing at about the same time.

Books by Acorn User authors Jim McGregor, Alan Watt, Tony Shaw, John Ferguson and Ian Birnbaum will also be there.

For details, and bulk discount information contact: Acorn User Exhibition, 20 Orange St, London WC2H 7ED. Tel: 01-930 1612.

Take a holiday with your micro

HOLIDAYS related to computing are now offered by several companies.

Wardle & Wardle use BBC micros for their general, special interest, professional and handicapped holidays. Tel: (0703) 558621.

The Inter Schools Christian Fellowship organises camping holidays for boys and girls, aged 14-16. Topics include radio, electronics and computing. Tel: (0734) 792569.

Finally, there are home computing courses using Beebs in North Berwick, near Edinburgh, hotel residential and non-residential. Contact: Ian Goodall, 14 Ware Rd, North Berwick, East Lothian EH39 4BN.

Brum hobby show

MICROSCENE is the title of a one-day computer exhibition to be held in Birmingham's Bingley Hall on September 10. It is a hobby and educational show designed to be non-profit making. Entrance will be 50p head.

Contact Eric Deeson, Microscene, Battenhall Rd, Birmingham 17.

School seminar

SCHOOL computing at 'O' and 'A' level is the subject of a one-day seminar on July 5.

Imperial College, London is the venue and the event will preview IUCC recommendations for university entrance requirements.

Bookings through Prof. D. Giles, Computer Science Department, University, Glasgow GL2 8QQ.

First three of the big chains muscle in

HIGH Street chains are moving into the computing market in a big way.

W.H. Smith's are set to stock their three computer shops in Birmingham Croydon and Northampton with BBC micros and Electrons. Ranges from seven software companies are already on their shelves, and firmware is being considered.

Boots are selling software from the BBC itself and Liverpool-based Bug-Byte. BBC micros could soon be in their larger stores – and the company has already taken delivery of several machines.

And music giant Virgin is to launch its own software range in June spearheaded by three games for the BBC micro. *Landfall, Bug Bomb* and *Space Adventure* are all for the model B, and should be fighting for record space in June.

Electrical goods come under software control

LIGHTING from single bulbs to theatre and disco rigs can come under the control of a BBC micro.

SJ Research of Cambridge make devices for just these purposes, from twin relays to 'intelligent' devices which allow dimming and fading of up to 32 channels.

The simpler versions are designed for domestic appliances such as TV, radio and central heating. A basic double relay costs £30.

The units plug into the RS232 port and mains supply. The appliance is then connected into the relay and comes under its control for power.

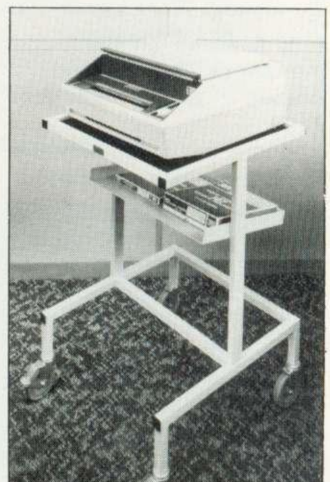
SJ Research claim several units can slave off one port, leading to a maximum of 1024 channels, under one micro.

Print statements from Basic are used to drive the devices, which were demonstrated in the BBC TV series *Making the Most of the Micro.*





Trolley choice for the home user

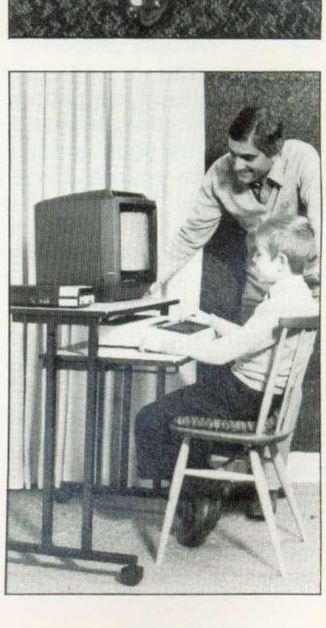


SEVERAL readers and schools have written in about trolleys, so here's a bumper choice from manufacturers who have contacted us.

Top left is the 'Didsbury' by Store Stock Systems in Altrincham, Cheshire. It costs £60, and the company makes three other sizes costing £45 to £70.

Next, we have two offerings from Kaymar who have a range of products, and hail from Pinxton, Notts.

Then, bottom right is a unit from Zygon Products of Brentwood, Essex. This one costs £59. None of these prices includes VAT.



Micro management market for managers

TOWN halls all over Britain look set to sprout Beebs to help local government executives cope with information technology.

The idea is that authorities buy a software pack designed to run on a Beeb with discs and monitor. It costs £350 and was written by Lamsac – a local authority management committee.

Three discs cover applications such as accounting and traffic control as well as demonstrating graphics and other techniques. The aim is to introduce managers to computing, boost efficiency and cut waste.

Lamsac has so far sold 60 packs – and hopes to make a surplus (LAs don't make profits) by selling the software to the public and private schools.

The group is based in Vincent House, Vincent Square, London SW1 and already produces literature as part of a management awareness project.

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6. CIRCUS — Your Car has run out of Petrol on a lonely road miles from habitation. As you trudge relunctantly down the road in search of help you are suddenly confronted by an amazing sight... in a nearby field is a Huge Circus tent! But this is no ordinary Circus as you will soon discover...
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*Adventures 5-10 require 32K RAM

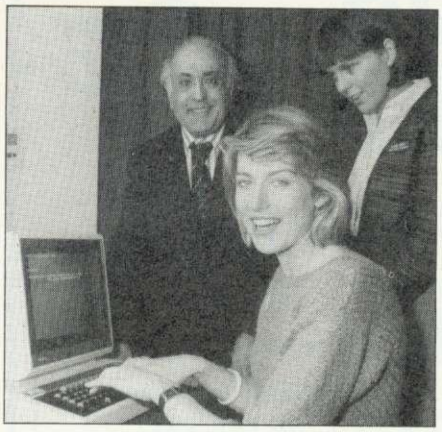
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Micro plays major role in medicine

TV personalities presenting micros is just the media gloss on a vital role of the BBC machine.

Hospitals in London, Manchester and other cities are using the machine as an intelligent interface and controller for sophisticated life support systems – with tremendous savings over traditional methods.

And a major role is appearing in helping the disabled and handicapped.

Charing Cross Hospital plans to use the Beeb handed over by Selina Scott in its speech therapy unit. This is one of five centres using the micro to control speech synthesis and visual aids which are tailored to suit individual patients.

In Norwich, one weekend's loan convinced a disabled couple that the BBC micro could change their lives.

Jack and Margaret Wymer are both in wheelchairs, and Jack can only type one digit at a time. However, they run a local toy library and write a regular column for the *Norwich Mercury*.

Margaret explained: 'We were lent a BBC micro with discs one weekend and it kind of took us over.

'We didn't realise at first how intriguing it was, but we were sad to see it go after just a weekend.'

They are now trying to get hold of a disc machine, but are having problems. *Acorn User* author Paul Beverley is designing a hardware change for the machine, while Charles Moir of Computer Concepts is trying to adapt *Wordwise* for their use.

The couple see the machine as invaluable for word processing, and for the rapid access it can give them to information.

The machine has changed John Richardson's life too. He was a chemist in Preston, but now markets a drug labelling system based around a BBC micro with a 96k expansion board.

Discs, monitor and printer complete the package which is designed to meet the requirement for printed drug labels.

It all started less than two years ago when he bought a second hand micro. Now he hopes that 3,000 chemists will soon be using his systems.

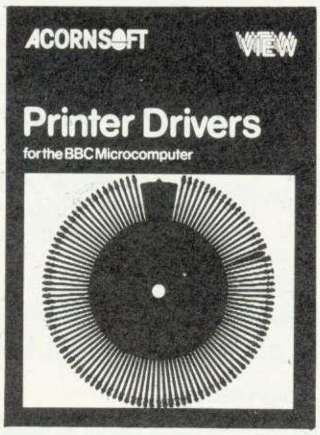
Games to follow

THE View printer driver cassette supports Ricoh, NEC, Epson, Olivetti, Diablo, Qume and Facit machines.

Codes dictate which of two facilities can be defined, with underlined and bold by default. A spreadsheet package is planned to accompany View.

Ten Acornsoft games are being converted for the Electron (the *Snapper* apparently goes beserk on the Beeb). Lisp and Forth are among them.

Hopper, Snooker, Chess, a personal money management pack, and four educational programs are on the way for the Beeb. Three of the last four are on chemistry, while the fourth, *Jars,* sounds like a version of *Jugs* which is available on the RML.



Subs rise as issues sell out

THE February issue of *Acorn User* is now completely sold out, and is the second issue to do so (July/August 82 being the first).

Unfortunately, the only way to obtain these now is through our photocopy service, when the July/ August issue will cost £3.75 and the February issue £5.50 (not including advertising pages)!

If you intend to order back issues, please do this as soon as possible as supplies of the several others are running down (see page 92 for details).

Also, the initial printing of *Acorn User* binders is selling fast, and it is unlikely that we will be able to hold the price at £3.95 inclusive for the next batch.

Rosy future for micro gardeners

SUPERWOMAN Shirley Conran has enlisted the Beeb's aid to teach the tips outlined in her book *The Magic Garden*. A program by the evergreen Acornsoft will recommend plants to match the would-be gardener's needs.

Shirley, who makes a living writing about things she claims to be no good at, apparently took to the Beeb like a duck to water. And Acornsoft plan a series of software by women for women around the idea.



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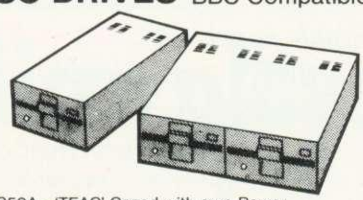
BBC MICROCOMPUTER

Model A £299 **Model B £399**
incl. VAT (carr £7)

UPGRADE KITS. Upgrade your Model A to Model B with our Upgrade Kits and save yourself £ s s s....

- BBC1 16K Memory (8 x 4816AP-3 100nS) **£16.00**
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- BBC3 Disk Interface Kit **£85.00**
- BBC4 Analogue I/O Kit **£6.40**
- BBC5 Serial I/O Kit **£6.70**
- BBC6 Expansion Bus Kit **£6.10**
- Printer Cable Ready made 36" **£11.95**
- Complete Upgrade Kit Mod. A to Mod. B **£43.00**

DISC DRIVES BBC Compatible



- CS50A – 'TEAC' Cased with own Power Supply, S/S 40 track, 5¼", 100K **£180**
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- CS50E – 'TEAC' Single case with own PSU, Single sided, 80 track, 5¼", 200K **£250**
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- **Single Mitsubishi** Slimline cased with own PSU DSDD. 1 Megabyte (400K with BBC) **£275**
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- 10 Verbatim Diskettes, 5¼", D/sided **£30**
- 10 Wabash Diskettes, 5¼", S/sided **£15**
- 10 Wabash Diskettes, 5¼", D/sided **£25**

BBC PRINTER GP100A



10" Tractor Feed, 80 Columns, 30 CPS normal & double width Characters. Dot res graphics. Parallel Interface Standard.

• Only **£175** (£7 carr) •

- **SEIKOSHA GP250X** 10" Tractor Feed, 80 col. 50 CPS, normal & double width & height characters, RS232 & Centronics Interfaces standard. **£235** (£7 carr)

NEC PC8023BE-C Printer

100 CPS, Bi-directional, logic seeking, 80 columns, 7 x 9 Dot matrix, superscript and subscript, hi-res block graphics, underlining, Tractor/Friction feed, reverse linefeed, 2K Buffer, proportional spacing. **£320** (£7 carr)

EPSON Printers FX80

10" Tractor/Friction feed, 160 CPS, 11 x 9 matrix, 137 columns max., Bidirectional, Logic seeking, proportional spacing, hi-res bit image, Italics & Elite Char, Subscript & Superscript.
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RX80

100 CPS, 9 x 9 matrix, dot addressable graphics, Condensed & double width printing, Normal, Italic & Elite Char. Tractor feed, bi-directional, logic seeking. Centronics Interface standard.
Only **£295** (£7 carr)

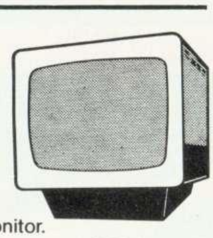
MX100FT/3

15" Carriage, 136 columns, plus all the facilities of MX80FT/3 Only **£425** (£7 carr)

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8½" or 9½" Fanfold paper plain or ruled (1000 sheets) **£7** (150p carr)
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MICROVITEC 1431. 14" Colour Monitor. RGB Input, (as used in BBC programmes). FREE Interface Lead.
£249 (carr £7)

ZENITH 12" Green Monitor. Hi-resolution **£75** (carr £7)
Monitor Lead: Phono to BNC **£3**

CASSETTE RECORDER & ACC.

Top quality slim-line, portable Cassette Recorder for Computer use. Mains/Battery operated with counter. **£26**

C12 Computer Grade **Cassettes** in library cases **40p**

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(Female Plug at one end, other end free)

SK9	Printer Cable (26 way Female)	**£3.15**
SK10	I/O cable (20 way Female)	**£2.40**
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SK12	Tube Cable (40 way Female)	**£4.25**

PRINTER LEAD 36" Ready made £11

MISCELLANEOUS CONNECTORS

	Plugs	*Sockets*
RGB (6 pin DIN)	**30p**	**45p**
RS423 (5 pin Domino)	**30p**	**40p**
Cassette (7 pin DIN)	**25p**	**65p**
ECONET (5 pin DIN)	**15p**	**25p**
Paddles (15 pin 'D')	**£1.10**	**£2.15**
Disk to BBC Power Plug 6 pin	**70p**	—
Disk Drive Power Plug 4 pin	**60p**	—

READY-MADE LEADS for BBC

CASSETTE LEADS: **7 pin DIN Plug**

to 5 pin DIN Plug + 1 Jack Plug	**£2.00**
to 3 pin DIN Plug + 1 Jack Plug	**£2.00**
to 7 pin DIN Plug	**£2.50**
to 3 Jack Plugs	**£2.00**

6 pin DIN to 6 pin DIN Plug (RGB)

BBC JOYSTICKS **£11.50/pr**

LIGHT PEN

All parts available for the Acorn User's "SHINE A LIGHT" Light Pen article for **£9.95**

Acorn ATOM UTILITY ROM

WEROM is Watford Electronic's own most sophisticated but easy to use 4K ROM based on BASIC extension for Acorn ATOM. Plugs straight into the utility socket in an ATOM with floating point. The special features are:
High Speed Tape Interface – Memory Dump, Modify Machine code breakpoints – BASIC Error Trapping – READ, DATA and RESTORE – Full BASIC Keyboard Scanner (BBC like) – FULL Disassembled – AUTO Line Numbering – PLUS: CHAIN, Cursor Movement, Loop Aborting – Easily Extendible further. Supplied complete with instructions. **£9.95**

NEW ... NEW ... NEW

BEEBPLOTTER

Watford Electronics' BEEBPLOTTER will work with 32K BBC Micro. Connects to Analogue port. The unique design makes it accurate and simple to use. The comprehensive booklet supplied, describes its use in details and shows some of the possible applications.

The special Features include:–

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- Commands printed on Tablet & On-screen instructions.
- Special routines enable pictures to be quickly loaded from tape.
- Works with all operating systems and ECONET. Tape and Disc versions available.
- Large drawing area (32cms x 23cms)
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- Transparent tablet enables maps & diagrams to be copied directly from books.
- Commands include line, circles & rectangle drawings, infilling, full editing and an easy to use copy and move feature.
- Screen dump routines included for Seikosha and EPSON printers.
- Routines are included to allow user to incorporate pictures in their own programs.
- Designed by a professional teacher with educational uses in mind.

Only **£59** (£3 carr)

★ SPECIAL OFFER ★

2764-250nS EPROM 1 + **425p** 25+ **395p**

EPROM COPYING SERVICE

Now available while-u-wait

£2 per chip

FORTH ROM for BBC

This superb compiling language now available in ROM. Simply plugs into one of the ROM Socket **£35**
Full FORTH Manual **£6.75**

School subsidy scheme is extended

FOUR products have been added to the micro subsidy scheme for Britain's 6,500 secondary schools.

Micros in Schools funding now covers the Educational Electronics Vela intelligent interface, Walters dot matrix printer, Economatics Buggy, Microvitec colour monitor, and upgrading the model A to B specification with Econet and disc interfaces.

The main part of the package – monitor, upgrade and printer costs £700 plus VAT and comes with a suite of software.

Details and application forms are now going to local education authorities and the scheme will run for a year.

Vela – *versatile laboratory* instrument – costs £180 + VAT. is based around an 8k suite of machine code programs in EPROM, with a 4k memory, and it can be programmed.

The device can be used on its own or be linked to a BBC micro.

The £124 Buggy is a three wheeled programmable robot which comes in kit form. It is controlled by the BBC micro and can read bar codes, detect collisions, follow a light source as well as acting as a Logo pen turtle.

BBC's TV series *Making the Most of the Micro* featured the Buggy (*Acorn User*, March) and the NEC is planning a course on control using it.

Walters WM2000 is a British, nine-wire dot matrix printer with a speed of 125 characters per second. It comes with an ASCII character set as standard, with special foreign founts available.

The department has been under pressue to include disc drives in the scheme, but has so far resisted this. However, the inclusion of the disc interface keeps this option open.



Walkers printer and Vela intelligent interface feature in new DoI incentive

Z80 business package

ACORN'S Z80 business software package will include major licensed products from Digital Research and Microfocus.

The Z80 Second Processor will be launched in August at £285, and the package is aimed at the small business market.

It aims to tackle three major areas: accounting, office productivity and programming.

The first part is made up of a daybook with sales and purchase ledgers, as well as a 'nucleus system generator' to help write programs without any programming skills.

Office productivity is covered by wordprocessing, spreadsheet and database software, all linked to a graphics display.

The third aspect consists of a programming system running CIS-COBOL (with Animator for debugging), a Microsoft specification Basic, and BBC Basic – all under the CP/M operating system with GSX graphics.

The ability to run CP/M with the Z80 processor will put the BBC machine into the mainstream of business computing.

The 6502 Second Processor also looks set for an August debut, but no firm dates for the 16032 machine are being given by Acorn.

Publisher calls

Addison-Wesley's School Division needs the assistance of a micro expert. We get a lot of technical queries regarding the implementation of educational software on a variety of machines – BBC, Spectrum, RML, PET and Apple.

If there's anyone out there who would be prepared to help, either in our offices or at home (remuneration by arrangement), phone Fergus Hall on 01-631 1636 or write to him at 53 Bedford Square, London WC1B 3DZ, outlining your experience.

Telesoftware is getting nearer

TELETEXT adaptors have just finished field trials and are set for production. The first batch should be despatched in July to those who have the device on order.

The BBC has been broadcasting telesoftware for several months, and is set to expand the range of programs carried.

Lawson Brown, head of the service expects to introduce games, utilities, reviews and general purpose programs.

WIN

£1100 Disc system

- ☐ BBC micro
- ☐ Single drive
- ☐ Ink-jet printer

Simon Dally presents the second part of our Hawk Dove Competition. Last month he introduced the idea, now we refine it and ask you to produce a piece of software. The behaviour of our animal world is open to interpretation, and this will be taken into account when choosing the winner.

LAST month we invited you to set up a computer model of an animal world where members adopt different strategies when they meet one another. This month we want you to expand the model into a fully-fledged program. But read carefully: several factors have been introduced and the scoring has changed significantly – with this prize at stake we expect you to work for it!

For those who missed last month's issue, a copy of the relevant pages will be helpful – and remember you must include the answer to last month's quiz, whether you entered or not.

First, a recap and some expansion. In any meeting or conflict between two members of the species there are three possibilities for each participant.

The hawk strategy (H) is a savage attack upon the opponent (total war).

The dove strategy (D) means the character holds its ground and makes a furious display without maiming or injuring the opponent (limited war).

The retreat strategy (R) means running away and 'losing' the contest. In addition, if attacked by an individual adopting a hawk strategy, the character risks death or serious injury.

All animals are pre-programmed – they adopt their individual strategies blindly and without choice. They also have no memory of previous conflicts and cannot distinguish between members of the species. In other words, when a hawk meets a dove neither knows what type the other is.

The purpose of our model is to determine the most stable strategy for the group as a whole – so stable that it is immune to a mutant strategy arising from within. As we saw last month, a society consisting entirely of hawks will be invaded by doves (according to our scoring) because individuals who run away score more points than those who engage in total war. And a society composed entirely of doves will be invaded by hawks because the first mutant hawk will do extremely well against a bunch of characters who merely run away.

The three characters we described last month were as follows: the hawk, always plays H; the dove, always plays D and runs away as soon as it encounters H; the bully plays H if making the first move, plays H in response to D, but runs away if its opponent plays H twice in succession.

Thus if A is a bully and B is a hawk the contest will look like this:

```
   1 2 3
A: H D Run
B: H H
```

Now we introduce two new characters.

The *retaliator* wanders around quite peacefully. If it encounters another individual it behaves like a dove initially. But if it meets a hawk it meets force with force. Thus we can say a retaliator plays H in response to H and D in response to D.

The *prober-retaliator* (PR) behaves similarly to a retaliator except every now and again it pretends to be a hawk (ie it probes). Like a retaliator, it plays H in response to H, except that if it probes and receives H in return it reverts to D. If it encounters D it takes advantage like a bully and plays H again.

All contests take place between two individuals (call them, say, A and B). In addition, if a contest goes as far as 21 rounds it stops automatically with the second contestant playing R. At the end of each contest, calculate the individual scores of A and B:

- For each 'victory' . . . +50 points
- For each loss (R) . . . 0 points
- For each hawk blow (H) received which does not cause death or serious injury (a scratch) . . . -2 points
- For death or serious injury . . . -100 points.
- For each round or part of a round the contest lasts beyond round 1 (wasting time) . . . -0.5 points.

If an animal is killed or seriously injured it scores only -100 points. All other scores are computed as a mixture of victory/loss points, time wasted and hawk scratches received.

The first contestant has a slight advantage (it gets in the first blow and wins if the contest goes a full 21 rounds). A useful analogy might be to think of A as being on its home ground.

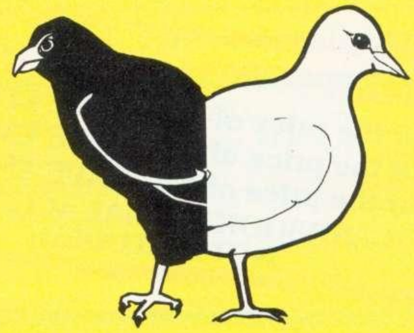
Few computer models can function without random factors being introduced. For those unfamiliar with probability theory, here is a crash course! If an event is *certain* to happen it is said to have a probability of 1.0. If an event will *never* happen it has a probability of 0.0. All other

Once you've written your software, and answered last month's quiz, send it to Acorn User, 53 Bedford Square, London WC1B 3DZ. Entries should arrive by Wednesday, August 3 and must be clearly marked 'Hawks and Doves'.

The overall winner will receive: BBC model B fitted with disc interface; single disc drive; Olivetti ink-jet printer.

Two runners-up will each receive software to the value of £50. A copy of *The Selfish Game*, the inspiration of this competition, will also go to each winner. The result will be announced in November's *Acorn User*, and winners will be notified by post.

Our thanks to Acorn, Richard Dawkins and Oxford University Press for their help with the competition.



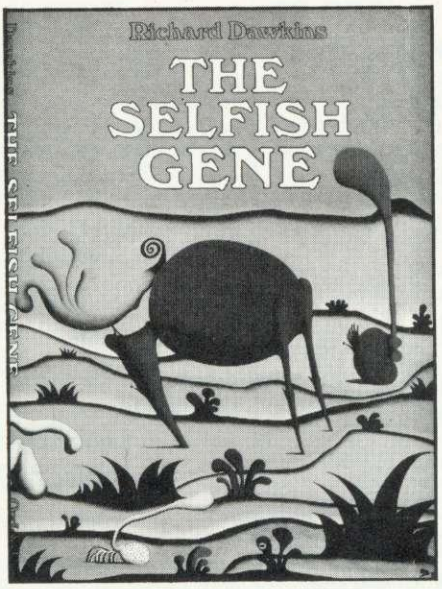
probabilities can be expressed somewhere in between. The probability of a tossed coin landing heads up is 0.5, which can be expressed in most Basics as RND(2).

The following probabilities occur in our model:

- That a single hawk strategy (H) will cause death or serious injury . . . 0.10
- That a prober-retaliator will probe on its first or any subsequent move . . . 0.05.
- That a retaliator of PR wil retaliate against a hawk strategy (assuming it isn't dead or seriously injured) . . . 1.0.

Our model is only a theoretical and abstract hypothesis. Real animal behaviour is vastly more complex (though the ritualised conflicts here will strike a chord with people who watch nature films on TV).

Do not attempt to read too much into our model (one person thought



The Selfish Gene
by Richard Dawkins, OUP, £8.50

an early version of last month's article was an attempt to simulate CND and other nuclear strategies!) Nor should words like 'hawk' and 'dove' confuse you into thinking our theoretical species is necessarily a type of bird.

Each of the strategies we're putting into the computer might be thought valid in one form or other. For example, the savage behaviour of hawks, carrying as it does a chance of death or serious injury might be applicable if we were examining a population of elephant seals, where the reward for winning a battle can be as high as a harem of 30 females. On the other hand, if we were analysing sea otters, who need to eat a quarter of their own body weight every day, we would clearly have to exact greater penalties for wasting time fighting instead of gathering food.

Once you've programmed your computer with the individual characters and their strategies you're ready to set them against each other in the silicon chip jungle. One technique would be a football league system whereby all play all at home and away. However, a system more in tune

page 20▶

Here are a few examples of possible conflicts:

Prober-retaliator v Retaliator

	1	2	3	4	5	6	7	8	9	10	11	12
A:	D	D	D	D	H	D	D	D	D	D	D	D
B:	D	D	D	D	H	D	D	D	D	D	D	D

	13	14	15	16	17	18	19	20	21	Score
A:	D	H	D	D	D	D	D	H	D	+34.0
B:	D	H	D	D	D	D	D	H	R	−16.0

Here the PR probes on its fifth, fourteenth and twentieth moves. The retaliator responds in kind by playing H and the PR immediately reverts to being a dove. On the twenty-first round both are still alive and B retires. Character A scores +50 for 'winning', plus (20* -0.5) for wasting time, plus -6 for his three hawk scratches received = +34. B Scores 0 for 'losing', plus -10 for timewasting, plus -6 for his three hawk scratches = -16.

Bully v Bully
this contest will look like this unless one is killed:

	1	2	Score
A:	H	H	+49.5
B:	D	R	-4.5

A scores +50 - 0.5 = +49.5. B scores 0 -4 -0.5 = -4.5.

Prober-retaliator v Hawk

	1	2	3	4	Score
A:	H	D	H	H	-100.0
B:	H	H	H	H	+42.5

Here the PR probes on its first move and reverts to D when it encounters H. The hawk continues to play H and on his fourth move kills A. A scores -100 for death. B scores +50 - 6 + (3* -0.5) = +42.5.

Gemini more progra[ms]

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5 for the price of 3 – SAVE £39.90!
7 for the price of 4 – SAVE £59.85!
(CASHBOOK & FINAL ACCOUNTS NOT INCLUDED)



CASH BOOK ACCOUNTS PROGRAM FOR BBC 32K, TORCH, SPECTRUM 48K
NEW £59.95

J. B. SNOOKER T/A POT BLACK

* TRIAL BALANCE AT 31/12/82 *

	ACCOUNT	DEBIT £	CREDIT £
1	Sales (1)		40000
2	Sales (2)		45001
7	Opening Stock & WIP	3000	
8	Purchases (1)	31600	
9	Purchases (2)	17150	
12	Closing Stock & WIP		5000
13	Sundry Income		700
14	Wages	8430	
15	Wife's Wages	1200	
16	Rent & Rates	1925	
17	Heat Light & Power	825	
18	Telephone	1620	
20	Insurance	211	
21	Motor Expenses	2560	
24	Repairs & Renewals	740	
27	Sundry Expenses	811	
28	Accountancy	600	
29	Legal & Professional	150	
31	Finance Charges	5510	
32	Bad Debts Written Off	1269	
33	Motor Vehicles - Dep'n	200	
35	Plant/Equipment - Dep'n	150	
36	Leasehold Property - Dep'n	100	
37	Loss/(Profit) on Sale of Assets	150	
47	Cash in Hand	500	
48	Bank (1)		34400
49	Band (2)	500	
50	Freehold Property	20000	
52	Leasehold Property	30000	
53	Leasehold Property - Acc Dep'n		5000
56	Motor Vehicles	4000	
57	Motor Vehicles - Acc Dep'n		500
58	Pland & Equipment	2500	
59	Plant & Equipment - Acc Dep'n		500
60	Goodwill	2000	
61	Debtors & Prepayments	2000	
62	Trade Creditors & Accruals		9300
65	H.P. (1)		900
69	H.P. Interest Res (1)	100	
74	VAT Input Tax	5163	
75	VAT Output Tax		9063
76	VAT Refunds/Payments	4400	
77	Capital A/c (1)		15000
78	Capital A/c (2)		5000
81	Capital Introduced (1)		500
85	Drawings (1)	8600	
86	Drawings (2)	12000	
89	Long Term Loans		4000
90	Stock & WIP	5000	
	TOTALS	174864	174864

N. B. Sundry Expenses debited by £1, due to rounding errors

One of the most innovative business programs on the market. Replaces a manual cash book system, e.g. Simplex and 'All-in-One'. Written by practising Chartered Accountants, this practical program is simple to use and will replace your manual cash and bank records. By giving you access to vital management information as and when you want it, it will enable you to keep more positive financial control of your business.

The software is extremely well and lucidly documented, and Gemini provide a full technical back-up and product up-date policy. Take a look at the information this program will provide:-

* Summary of VAT information for VAT returns * Cumulative receipts and payments report analysed over the standard profit and loss and balance sheet headings * Option for departmental analysis of sales and purchases * Audit trail printout of all transactions. * Journal routine for entering transfers between accounts and year end adjustment for debtors, creditors etc. * Trial balance at any interval * Interfaces to 'Final Accounts' program to produce balance sheet and trading and profit/loss account etc. * Spectrum version may be used with Sinclair OR 80 column printer.



FINAL ACCOUNTS PROGRAM FOR BBC 32K, TORCH, SPECTRUM 48K. £59.95

NEW

Requires Cash Book module. This program will take your cash book data to the logical conclusion of balance sheet, trading and profit/loss account and notes to the accounts i.e. fixed assets, land and buildings and capital accounts. Final accounts (BBC version) links to 'Beebplot' for graphic data presentation.

Format: Torch disk, BBC disk/cassette, Spectrum cassette.

Special Offer – Cash Book and Final Accounts together – £95

J. B. SNOOKER T/A POT BLACK

* BALANCE SHEET AT 31/12/82 *

	1982 £	1981 £
Fixed Assets	50500	30950
Goodwill	2000	2000
	52500	32950
CURRENT ASSETS:		
Stock & WIP	5000	3000
Debtors & Prepayments	2000	4000
Cash in Hand	500	200
VAT recoverable	500	
	8000	7200
LESS CURRENT LIABILITIES:		
Trade Creditors & Accruals	9300	3300
H.P.	800	1000
Bank Overdraft	33900	8250
VAT payable		600
	44000	13150
NET CURRENT ASSETS/(LIABILITIES)	(36000)	(5950)
NET ASSETS/(LIABILITIES)	£ 16500	£ 27000
REPRESENTED BY:		
Capital A/c (1)	13300	16000
Capital A/c (2)	(7000)	6000
Long Term Loans	4000	5000
	£ 16500	£ 27000

J. B. SNOOKER T/A POT BLACK

* TRADING AND PROFIT/LOSS ACCOUNT *

PERIOD: 1 YEAR ENDED 31/12/82

	1982 £	1981 £
Sales (1)	40000	[illegible]
Sales (2)	45001	[illegible]
TOTAL SALES	85001	52002
Opening Stock & WIP	3000	2000
Purchases (1)	31600	[illegible]
Purchases (2)	17150	[illegible]
	51750	[illegible]
Closing Stock & WIP	(5000)	(3000)
COST OF SALES	46750	29945
GROSS PROFIT (%)	38251 (45%)	22057 (42%)
Sundry Income	700	[illegible]
	[illegible]	[illegible]
LESS EXPENSES:		
Wages	8430	[illegible]
Wife's wages	1200	1200
Rent & Rates	1925	[illegible]
Heat Light & Power	825	[illegible]
Telephone	1620	1470
Insurance	211	[illegible]
Motor Expenses	2560	[illegible]
Repairs & Renewals	740	[illegible]
Sundry Expenses	811	[illegible]
Accountancy	600	[illegible]
Legal & Professional	150	[illegible]
Finance Charges	5510	[illegible]
Bad Debts Written Off	1269	[illegible]
TOTAL EXPENSES	25751	[illegible]
DEPRECIATION:		
Motor Vehicles	200	[illegible]
Plant/Equipment	150	150
Leasehold Property	100	100
Loss/(Profit) on Sale of Assets	150	[illegible]
TOTAL DEPRECIATION	600	[illegible]
TOTAL OVERHEADS	[illegible]	[illegible]
NET PROFIT/(LOSS)	£ 12600	[illegible]

NOTES TO THE ACCOUNTS - 31/12/82

1. FIXED ASSETS

	Land & Buildings £	Motor Vehicles £	Plant & Equipment £	TOTAL £
Cost or Valuation	50000	4000	2500	56500
Acc. Depreciation	5000	500	500	6000
NBV - 1982	£45000	£3500	£2000	£50500
NBV - 1981	£25100	£3700	£2150	£30950

2. LAND AND BUILDINGS

	1982 £	1981 £
Land and buildings comprise:		
Freehold Property	20000	
Leasehold Property	25000	25100
	£45000	£25100

3. CAPITAL ACCOUNTS

	(1) £	(2) £
Add: Opening Capital	15000	5000
Capital Introduced	500	0
Profit/(Loss) for Year	6300	6300
	21800	11300
Less: Drawings	(8600)	(12000)
	£ 13200	£(700)

"Gemini's range of software is in the vanguard of the releases for 'serious' micro users . . ."
(WHICH MICRO AND SOFTWARE REVIEW)



INVOICES AND STATEMENTS . . .£19.95

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3
4                                   Oct.        Nov.
5                                    £           £
6     INCOME
7     Sales                         11786       10944
8                                   -----       -----
9
10    REVENUE EXPENDITURE
11    Purchases                       500         500
12    Advertising                     500        1000
13    Director's salary              1596        1596
14    Salaries                       2216        2216
15    Rent
16    Telephone                                   300
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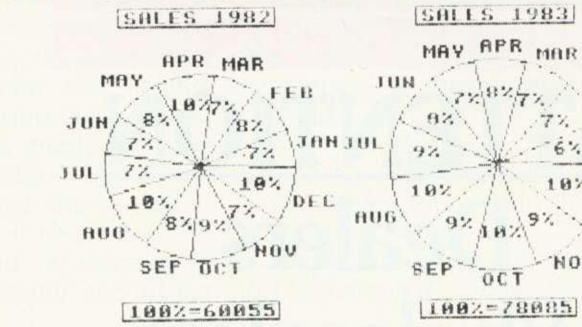
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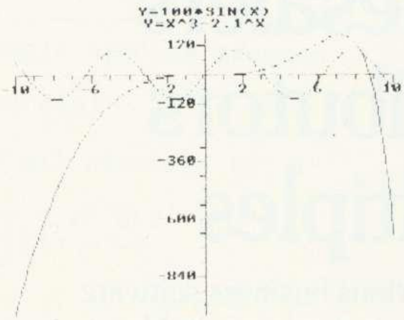
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Sharp MZ80K	●	●	●	●				●	●		
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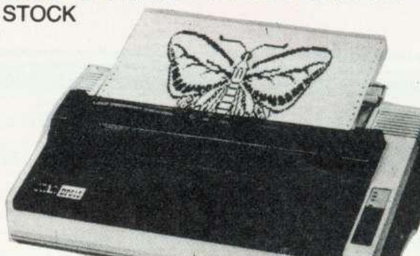
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HASHING IS SMASHING

Stan Froco uses hash tables for storing and retrieving data

IT IS often necessary to look up information associated with an item of data. For example in a compiler or assembler you may wish to know whether a variable has been used, and if so where in memory to find it. Such operations are usually done many times, and so must be efficient. This is where 'hashing' comes in as it is a compact and efficient technique for storing and retrieving such information.

Consider the following problem (courtesy Frank King, Cambridge University). A file Data, holds about 500 integer numbers in the range 0 to 9999. You have to find whether all the numbers are different, and if not how many duplicates there are.

This is similar to the above compiler problem. A simple method would be to take each number in turn and look at the rest of the file, to see how many times it was duplicated.

However, this would require 124,500 accesses of the file –which is tediously slow from memory, never mind tape!

Program 1 uses a hash table to solve the problem. An array of 650 elements, tab%, the hash table, is declared, and all the elements set to -1 (lines 30-60). Each number in the file is then taken in turn (line 210). The remainder after dividing this number (x%) is then calculated (n% in line 220). This conveniently gives us a number in the range 0 to 649, the same as the number of elements in the hash table, tab%. This element is then looked at (tab%(n%), lines 230 and 240). If its value is -1, nothing has been done to it since it was initialised (lines 70-90), so the number under consideration (x%) is stored in there and the next number taken (lines 320 and 330). If instead the value of the element is x%, then x% must have been stored there previously, in other words we have a duplicate.

The variable dup%, the count of duplicates (initially zero) is incremented by one, and the next number is taken (lines 240 and 330). The only other possibility is that a value other than x% or -1 is stored there. This may have been because a previous value of x%had the same remainder n%. In this case n% is increased by one until an element that is empty or holds x% is found (lines 280-300).

Line 290 includes the operation MOD 650 so that if n% is 649 the next element tried is element 0, avoiding falling off the end of the hash table. This process of looking for another element is rehashing (the initial process of taking a remainder, or hash value being hashing).

After all numbers have been looked at, dup% holds the number of duplicates found, and the result is printed.

Some care has to be taken with this technique. An array 30% bigger

```
10REM Example hashing program
20
30DIM tab%(649)
40
50REM Set all elements to -1
60
70FOR i% = 0 TO 649
80    tab%(i%) = -1
90NEXT i%
100
110dup% = 0
120handle% = OPENIN("DATA")
130
140REM Now take each element from the data file
   and look it up
150REM in the hash table.
160REM x% is the number being looked up
170REM n% is the possible element in the hash table
180REM dup% is the number of duplicates
190
200REPEAT
210    INPUT £handle%,x%
220    n% = x% MOD 650
230    IF tab%(n%) = -1 THEN GOTO 320
240    IF tab%(n%) = x% THEN dup% =
   dup% + 1 : GOTO 330
250
260    REM Try the next element in the
   table until found
270
280    REPEAT
290       n% = (n% + 1) MOD 650
300    UNTIL (tab%(n%) = -1) OR (tab%(n%) = x%)
310    IF tab%(n%) = x% THEN dup% =
   dup% + 1 : GOTO 330
320    tab%(n%) = x%
330UNTIL EOF £handle%
340CLOSE £handle%
350
360REM Print out the answer
370
380PRINT "There are " ; dup% ; " duplicates"
390END
```

Program 1. Hashing with a closed table

than needed (650 as opposed to 500 elements) was used as the hash table. The technique is only efficient if there is a good chance of finding an empty element, otherwise a lot of rehashing is done. In this example even when the 500th number is examined, the table is only about 70% full, meaning on average only two rehashes will be required. A rule of thumb is to allow 20% – 30% spare room. If the table were ever to become full, lines 280-300 would repeat forever looking for an empty element.

A suitable function is also needed to obtain the remainder. Imagine instead the problem involved floating point numbers in the range 0 – 0.9999. Then line 220 would give 0 each time as the remainder. By the time the last number was examined 499 rehashes would be required. The trick here would be to multiply the number in question by 10,000 and then take the remainder. The important thing is that the initial hashing must give elements well distributed throughout the table.

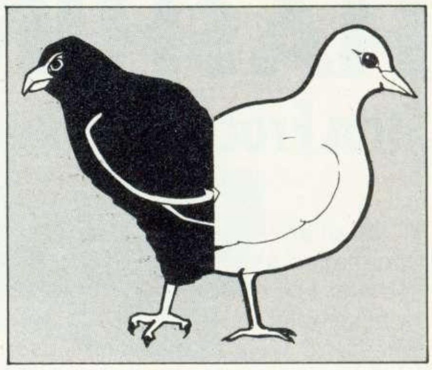
The technique is easily extended. For a symbol table the array could be a string array, with possibly another array, the corresponding elements of which contained addresses of the variables. Here the names could be hashed by taking the ASCII values of the first and last letters, ANDing them and taking a remainder.

The system described is a closed hash table. An alternative is the open table, which does away with rehashing. The elements of the tables contain pointers to a linked list of items with the same hash value. Such a list can never become full, the lists just become longer. To look up an item involves searching down the relevant list, hence short lists are preferred. This sort of table is often more flexible if a lot of data is stored with each item. If you don't understand what a linked list is, all will be explained in a future article.

If there is a programming technique or problem you would like Stan to look at, jot it on a postcard and send it in.

▶ *page 15*

with the real world would be to imagine each generation of animals indulging in a series of random conflicts. A new generation then arises whose composition is based on the performance of its predecessors (winners contribute more to the gene pool than losers) and battle recommences.



If you encounter genuine ambiguities don't call us! It's practically impossible to set this sort of problem in a totally unambiguous way. Suffice to say we're not trying to fox people with verbal quibbles. If in doubt, use your common sense and think about what happens in the real world. State your assumptions as REMs, if you want to.

Your model should allow the possibility of experimenting with different scoring systems and also allow any combination of characters the operator wants. Beyond these guidelines we're not going to tell you how to set up a model. However, in judging the entries the following criteria will be taken into account:

- Does the model accurately reflect the performance of the different strategies outlined?
- is the program clear to follow both when listed and when run.
- is the program visually pleasant to look at – ie is it free from spelling mistakes and has an attempt been made to interest the view with graphics?
- is it error-trapped, ie are unused keys disabled, is the player's input checked?

We don't expect all these points to be fully covered – but try! Also, entries are not limited to Beebs and Atoms – we will consider software for any comparable micro.

Remember the rules

- You must answer last month's first part, whether you entered or not, to qualify this month.
- Programs submitted should be on cassette or disc. With a listing if possible.
- All programs submitted will become the property of *Acorn User* and the magazine will retain all rights. We regret no material can be returned.
- Finally, the Editor's decision is final. We will not discuss the competition on the phone or by mail. The only possible form of correspondence will be through the letters pages, after the closing date of **Wednesday, August 3.**

RESULTS OF MARCH COMPETITION

THERE was a fairly heavy response to our March problem concerning the raffle tickets: over 200 entires, although a surprising number (38%) got it wrong. The answer was that the winning ticket was 10073 and the second prize 11220. The winners were G. Kirby of Hemel Hempstead, who solved it on an Acorn Atom, and Edmundo Herrerro of the BBC Micro Club, Tenerife. Acornsoft packages have been despatched to both winners.



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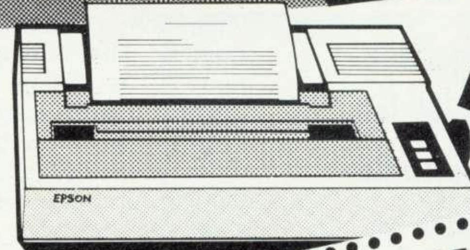


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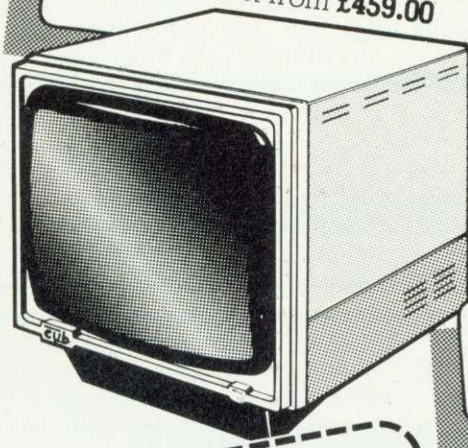
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NOT THE BBC MICRO

If logic is getting you down, let Joe Telford explain the Beeb's built-in facilities

This month we look at some of the ways logic can be used with the BBC micro. We start off with the AND logical operator. Consider program 1 which shows how we might implement a simple range check. The program expects a number between 1 and 12 inclusive to be entered, and will not exit from the repeat . . . until loop until such a number is input.

Line 50 contains the logic which defines the range of numbers. It simply says 'only exit from the loop when both conditions are fulfilled together'. That is when the number input (M) is greater that 0 *and at the same time* is also less than 13.

To examine this combination of conditions, we should consider each in turn. The first is a M > 0, which may take two values. It may be true, in which case M is any value greater than 0, such as 1, 3, 12, 99 . . . etc. Or the expression M>0 may take the value false. In this instance M is equal to zero or less, for example: 0,-2,-12,-89 . . . Figure 1 shows the range of numbers for which M>0 is true. Again, the second condition, M < 13, can also be true (M is less than 13) or false (M is 13 or more). Figure 2 shows the range of true values for this condition. The two conditions are connected by the AND operator, which specifies how combinations of true and false for each condition should be read. Figure 3 shows the range which allows exit from the loop.

It is also important to list all combinations of each condition, and their outcomes under the AND operation. Figure 4 does this.

Generally, the AND combination for any two conditions can be represented by a more general, and

Figure 1. M>0 true

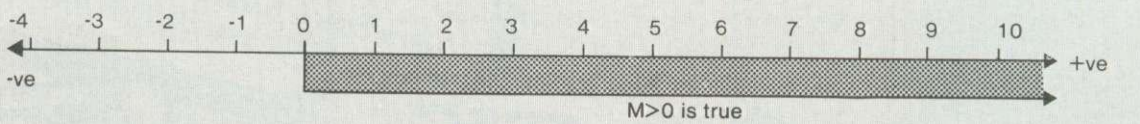


Figure 2. M<13 true

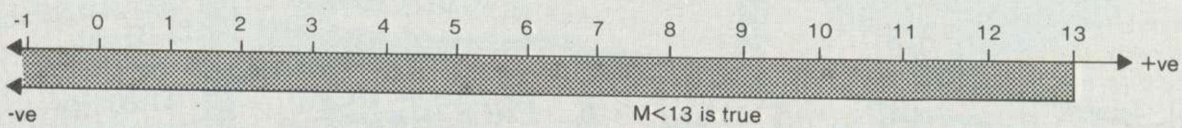
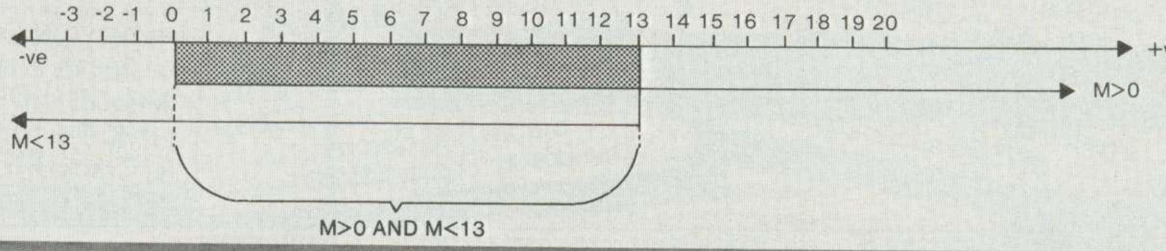


Figure 3 M>0 and M<13 true




```
   10month$=
"JANFEBMARAPRMAYJUNJULAUGSEPOCTNOVDEC"
   20REPEAT
   30CLS
   40INPUTTAB(0,9)"ENTER THE MONTH
(FROM 1 TO 12) "M
   50 UNTIL M>0 AND M<13
   60 PRINT''"THAT MONTH'S NAME IS
"MID$(month$,(M-1)*3+1,3)
```

Program 1. Repeat until range check

```
   10REPEAT
   20REPEAT
   30CLS
   40INPUTTAB(0,9);"ENTER MONTH (eg
JAN) " M$
   50P =
INSTR("JANFEBMARAPRMAYJUNJULAUGSEPOCTNO
VDEC" ,M$)
   60 UNTIL P AND LENM$=3
   70REPEAT
   80CLS
   90INPUTTAB(0,9);"ENTER THE DAY
NUMBER " D
  100UNTIL (D>0)=(D<32)
  110IFM$="FEB" AND D>28 PROC_err:UNTIL
FALSE
  120IFM$="SEP" AND D=31 PROC_err:UNTIL
FALSE
  130IFM$="APR" AND D=31 PROC_err:UNTIL
FALSE
  140IFM$="JUN" AND D=31 PROC_err:UNTIL
FALSE
  150 IFM$="NOV" AND D=31PROC_err:UNTIL
FALSE
  160CLS
  170PRINTTAB(0,9)M$;" ";D;" IS OK."
  180 etc.
 1000DEFPROC_err
 1010PRINT'"Too many days for that
month"
 1020PRINT'"Press SPACE bar"
 1030*FX15,0
 1040REPEAT UNTIL GET=32
 1050ENDPROC
```

Program 2. Getting the right date

Condition 1 M>0	Condition 2 M<13	AND function M>0 AND M<1	(Result)
FALSE	FALSE	FALSE	(Don't exit)
FALSE	TRUE	FALSE	(Don't exit)
TRUE	FALSE	FALSE	(Don't exit)
TRUE	TRUE	TRUE	(Exit)

Figure 4. Truth table for AND function

A	B	A AND B
0	0	0
0	1	0
1	0	0
1	1	1

Figure 5. Simplified Truth table

Condition A M>0	Condition B M<13	Condition C M=INT (M)	AND function M>0 AND M<13	(Result)
0	0	0	0	(Don't exit)
0	0	-1	0	(Don't exit)
0	-1	0	0	(Don't exit)
0	-1	-1	0	(Don't exit)
-1	0	0	0	(Don't exit)
-1	0	-1	0	(Don't exit)
-1	-1	0	0	(Don't exit)
-1	-1	-1	-1	(Exit)

Figure 6. Truth table for AND function

Conditions	Outcomes
1	2
2	4
3	8
4	16
5	32

Figure 7. Conditions to Outcomes table

more easily written truth table (figure 5). Here we replace condition 1 by the letter 'A' and condition 2 by 'B'. The true value is replaced by a number 1 (or -1 if you are a BBC purist) while false is replaced by 0. But how can we so blithely allocate number (particularly 1 and 0) to the outcome of the AND condition set up on the BBC micro? The answer is that providing that condition can only be satisfied in two ways, as for example a condition which can only be true or false, or a question which can be answered only yes or no, then we can accept 1 and 0 as shorthand terms.

The BBC micro goes one step further, however. Type:

```
PRINT 7=7
```

you should see the answer -1. Now try:

```
PRINT 7=1 or PRINT 7=14
```

you should see the answer 0.

O.K. so this is strange. Normally we are used to the = sign being an end in itself, but on the BBC micro, we need to alter our thinking. A better approach would be:

PRINT (Answer to question: 'is 7 equal to 7?')

or

PRINT (Answer to question: 'is 7 equal to 14?')

Obviously the answer to one question is yes and to the other no. The BBC simply translates the answers into terms it recognises, and which we can use further.

It would be extremely useful for readers to experiment with similar print statements, working through the normal operators. For example:

```
PRINT 5>2
PRINT 5>7
PRINT 4<2
PRINT 4<8
```

will help to give a feel for the machine's interpretation of these operators. Looking for extensions to program 1 at line 50, we require the computer to return a value of -1 or true when M>0 AND M<13. We should be able to provide this answer without the use of the AND connector. By clever (the Editor said that, honest) use of operators, we arrive at a new line:

```
50 UNTIL (M>0)=(M<13)
```

which mimics the AND statement.

The reason for the success is that M>0 becomes -1, and M<13 becomes -1 only when a number in the range 1 to 12 is entered. The = sign forces a final result of -1 only in this case. The other time when the = sign would present a -1 result is when M>0 and M<13 both return answers of 0, because in BBC logic 0=0 returns -1. However, because we are entering only 1 number, it cannot at one time be both less than 1 AND greater than 12. So the case of 0=0 never appears and the range can be checked adequately. It should be noted however that not every AND connector can be replaced by the formula in the new line 50.

Readers should make full use of the AND connector, as it enables quite complex one line branches to be constructed, combining the result of numerical calculations and string handling. Program 2 demonstrates this.

Program 1 has one major flaw. Run it and try typing a month number of 8.6. This results in the program displaying a month called 'UGS', which doesn't normally exist. The 'fix' for this is to ensure the number entered is an integer. This can be most efficiently done by replacing the variable M with M%. However for the purposes of examining further the AND operator we could alternatively alter line 50 to:

```
UNTIL M>0 AND M<13 AND
  M=INT(M)
```

Note that in this context M=INT(M) means: 'Is M a whole number (integer)'. Also M=INT(M) could be replaced with M=M DIV 1. We can use an extended truth table to examine which combination of true or false satisfies the repeat . . . until loop's exit condition. This is done in

figure 6. For three outcomes, and this number is calculated by:

Number of possible outcomes =2^number of conditions

and this means the number of outcomes can be tabled as per figure 7.

As far as the AND function is concerned, only one outcome is true. Looking back at line 50 of program 1 we have:

50 UNTIL M>0 AND M<13 AND M=INT(M)

this we know can be altered to:

50 UNTIL (M>0)=(M<13) AND M=INT(M)

but we can further extend it to:

50 UNTIL ((M>0)=(M<13))< ((M=*INT(M))*=0)

Try altering line 50 as shown and confirm that only integers between 1 and 12 are accepted. The truth tables in figure 8 explain this. The third table shows only one true condition, when M lies between 1 and 12 and is an integer.

The logical OR operator connects expressions together in a different way. Examine program 3. Lines 40 and 80 show one way of handling input which may be in one of two states. Anything else is automatically rejected. However, we cannot take our truth table from either of these lines, because one possible condition never occurs, ie where we input on and off together. Of course, with one input we cannot enter two things, and so we need to look elsewhere for a suitable line to demonstrate the full OR function. The OR operator is also used in line 110, and the whole program will demonstrate its use.

Imagine you are in a room with only two light sources (no windows). You have two switches, each of which controls its own lamp. Program 3 simulates what happens as you open or close each switch (turn each lamp on and off). Figure 9 is an uncompleted truth table in terms of on and off which readers might like to complete as they run the program. We should be able to relate the answers from this truth table to the BBC logic states: -1 (true) and 0 (false). These produce the truth table of figure 10.

M>0	M<13	(M>0)=(M<13)
0	0	-1 N.B. This never occurs
0	-1	0
-1	0	0
-1	-1	-1

Figure 8a. Truth table for (M>0)=(M<13)

M=INT (M)	0	(M=INT (M) =0)
0	0	-1
-1	0	0
0	0	-1
-1	0	0

Figure 8b. Truth table for ((M=INT(M))=0)

((M>0) = (M<13))	((M=INT (M)) =0)	((M>0) = (M<13))< (M=INT (M) =0)
-1	-1	0
0	0	0
0	-1	0
-1	0	-1

Figure 8c. Truth table for full function

Condition of lamp 1 (On or Off)	Condition of lamp 2 (On or Off)	Room dark or light?

Figure 9. Truth table for OR operator

Condition A	Condition B	A OR B
0	0	0
0	-1	-1
-1	0	-1
-1	-1	-1

Figure 10. OR Truth table using logic states

It should be noted that the last line of the figure 10 truth table (when A is true and B is true) gives an acceptable true output. Readers needing to handle exclusively 'A or B' but 'A and B' will find this covered later.

It is of course possible to increase the number of OR operators in a line. For example:

IF M$="FEB" OR M$="APR" OR M$="MAR" THEN . . .

is quite acceptable, and the IF condition is then satisfied if any one, or more than one expression is true. Figure 11 demonstrates the truth values for three OR operators.

```
   10REPEAT
   20CLS
   30INPUTTAB(0,9)"LAMP 1  ON  OR  OFF?
"L1$
   40UNTIL L1$="ON" OR L1$="OFF"
   50REPEAT
   60CLS
   70INPUTTAB(0,9)"LAMP  2 ON OR OFF? "
L2$
   80UNTIL L2$="ON" OR L2$="OFF"
   90CLS
  100PRINTTAB(0,9);
  110IFL1$="ON" OR  L2$="ON"  PRINT"YOU
 CAN SEE!" ELSE PRINT"IT IS DARK!"
  120END
```

Program 3. Demo of OR logical operators

OR and AND operators can be used together within a conditional line. Referring to program 2, we can replace lines 110 and 150 with:

```
110 IF(M$="FEB" AND D>28)
   OR ((M$="SEP" OR
   M$="APR" OR M$="JUN"
   OR M$ ="NOV") AND D=31)
   PROC_err:UNTIL FALSE
```

Brackets must be used with logical operators, so their sense is retained. The new line 110 has two main conditions. An error is flagged if the condition:

```
(M$="FEB" AND D>28)
```

is true, OR if the condition:

```
((M$="SEP" OR M$="APR" OR
   M$="JUN" OR M$="NOV")
   AND D=31)
```

is true. This latter condition can be further broken down to two other conditions:

```
(M$="SEP" OR M$="APR" OR
   M$="JUN" OR M$="NOV")
```

This becomes true if any of the months in the list has been selected. The true or false result of this is ANDed with D=31 so we can identify the other months with less than 31 days.

Condition A	Condition B	Condition C	A OR B OR C
0	0	0	0
0	0	-1	-1
0	-1	0	-1
0	-1	-1	-1
-1	0	0	-1
-1	0	-1	-1
-1	-1	0	-1
-1	-1	-1	-1

Figure 11. Truth table for three OR operators

Condition A	Condition B	A * B
0	0	0
0	-1	0
-1	0	0
-1	-1	+1

Figure 12. Truth table for A * B

Condition A	Condition B	A + B
0	0	0
0	-1	-1
-1	0	-1
-1	-1	-2

Figure 13. Truth table for A + B

Condition A	NOT A
0	-1
-1	0

Figure 14. Truth table for NOT A

Looking at program 2, it is possible to convert the month names to numbers. The variable P does this in line 50. If we improve on line 60, we can guarantee that only the correct three letter abbreviations can be entered.

```
60 UNTIL P MOD 3=1 AND
   LENM$=3
```

Examining P, we find it takes the values 4,10,16,25,31 for the months Feb, Apr, Jun, Sept, and Nov. These are the months where the number of days is less than 31. Line 110 can be amended as follows:

```
110 IF ((P=4) AND (D>28)) OR
   ((P=25 OR P=10 OR P=16
   OR P=31) AND D=31)
   PROC_err: UNTIL FALSE
```

This line is useful because we can now consider how to write the full condition without AND or OR operators. Unlike the AND range check which we examined earlier, the AND in

```
((P=4) AND (D>28))
```

is able to take all values from the AND truth table. This means we cannot replace the AND with an = sign as we did before. Look at figure 12, which is the result of multiplying the values of a truth table.

This is so close to the truth table for AND that the BBC micro will actually accept * inplace of AND in numerical logic calculations. Actually, the BBC micro recognises 0 as false and anything else as true. This means our expression can be written:

```
110 IF((P=4)*(D>28)) OR ((P=25
   OR P=10 OR P=16 OR
   P=31)*(D=31)) PROC_err:
   UNTIL FALSE
```

which leaves us looking for an equivalent to the OR operator. Look at figure 13 which is the truth table for addition.

Again, because of the way which the BBC recognises true, this table is accepted as the equivalent of the OR truth table. Hence we can rewrite line 110 completely:

```
110 IF((P=4)*(D>28))+(((P=25)
   +(P=10)+(P=16)+(P=31))*
   (D=31)) PROC_err: UNTIL
   FALSE
```

One word of caution! It is possible for the situation to arise where the arithmetic returns a false OR reading. Imagine that one condition (ANDed with the * sign) produces +1 while another condition (ORed with a + sign) produces -1. If the results are ORed again with a + sign, they will in fact cancel out, because -1+1=0. Providing readers are aware of this, there is no reason why concise coding of conditionals cannot be achieved.

The NOT operator is different from AND and OR. First, because it only works with one value, and second because it only works with

a numerical value. Try typing:

P.NOT("JAN"="JAN")

The result should be '0'. What has happened is that ("JAN"="JAN") results in the numerical value -1 (true) and the NOT operator changes that to '0'. Figure 14 shows the short NOT truth table.

Logically, the NOT operator reverses a true state to a false state and vice versa. However the NOT operator works arithmetically too. Look at program 4, which simply NOTs any number which you enter. It seems as though the NOT operator performs the same function as:

30 P."'NOT value is";-1*no-1

One last logical operator for this month is the EOR connector, which stands for 'Exclusive OR' and program 5 simulates this.

On running the program a darkened staircase appears, with a lamp turned off. At top and bottom of the stairs two light switches are marked 'down'. The one which is flashing indicates your position on the staircase. To move upstairs simply press the cursor up key. To move downstairs, press cursor down. The flashing switch position will change as you move up or down. To alter a switch, at your current position, just press 'U' to set that switch into the up position or 'D' to set it down. The light switches on or off depending on the switch positions of both switches. Figure 15 shows a truth table which readers might fill in.

The EOR function is used in line 370 to decide whether the switches are set alike, or whether they are different. The light is only turned on if the switches are set differently.

The most common equivalent of the EOR operator is the not equal sign <>. This would allow us to rewrite line 370 as follows:

```
370 IF SW$(1)<>SW$(0)
    VDU19,0,7;0;: VDU19,4,6;0;:
    VDU19,5,1;0;: ELSE
    VDU19,0,0;0;: VDU19,4,4;0;:
    VDU19,5,5;0;
```

```
5CLS
10REPEAT
20INPUT'"ANY NUMBER > " no
30P.'"NOT value is:- ";NOTno
40UNTIL FALSE
```

Program 4. Using the NOT operator

Upstairs switch up or down	Downstairs switch up or down	Light on or off
UP	UP	
UP	DOWN	
DOWN	UP	
DOWN	DOWN	

Figure 15. Upstairs/Downstairs Simulation Truth table

```
10ON ERROR GOTO460
20*FX4,1
30level=0:MODE2:COLOUR130
40VDU23;8202;0;0;0;
50GCOL0,132:CLG
60GCOL0,5:PROC_rect(0,0,1280,100,1)
70GCOL 0,0:FOR x= 100 TO 700 STEP 50
80PROC_rect(100+x,x,1180-x,50,1)
90NEXT
100FOR x= 200 TO 800 STEP 100
110MOVE x,x-100:DRAWx,x+100
120NEXT
130FOR x= 900 TO 1200 STEP 100
140MOVE x,700:DRAWx,900:NEXT
150MOVE1280,900: DRAW800,900:
DRAW190,290
160MOVE1280,800: DRAW800,800:
DRAW190,190
170MOVE100,1024: DRAW112,992:
PLOT85,164,1024
180PLOT85,148,992
190MOVE132,992:DRAW132,960
200MOVE50,940:PLOT85,214,940
210MOVE120,940:MOVE120,920
220PLOT85,144,940
230PLOT85,144,920
240MOVE124,916:DRAW140,916
250MOVE128,912:DRAW136,912
260DIMY(1),SW$(1):Y(0)=2:Y(1)=(20)
270SW$(0)="DOWN":SW$(1)="DOWN"
280FOR P= 0 TO 1:PRINTTAB(15,Y(P));
SW$(1):NEXT
290REPEAT:A=INKEY(0)
300IF A=138 level=1
310IF A=139 level=0
320COLOUR3:PRINTTAB(15,Y(1-level));
SW$(1-level):COLOUR 9:PRINT
TAB(15,Y(level)); SW$(level)
330IF (A=85)*level SW$(1)=" UP "
340IF (A=68)*level SW$(1)="DOWN"
350IF (A=85)*(level=0) SW$(0)=" UP "
360IF (A=68)*(level=0) SW$(0)="DOWN"
370IF (SW$(1)=" UP ") EOR (SW$(0)="
UP ") VDU19,0,7;0;: VDU19,4,6;0;:
VDU19,5,1;0;: ELSE VDU19,0,0;0;:
VDU19,4,4;0;: VDU19,5,5;0;
380UNTIL 0
390END
400DEFPROC_rect(x,y,l,w,f)
410MOVEx,y:DRAWx+l,y
420IFf=0 DRAWx+l,y+w ELSEPLOT85,x,y+w
430IFf=0 DRAWx,y+w ELSEPLOT85,x+l,y+w
440MOVEx,y+w:IFf=0 DRAWx,y ELSE
MOVEx,y
450ENDPROC
460MODE7:PRINT" at ";ERR:*FX4,0
470END
```

Program 5. Simulation of the EOR operator

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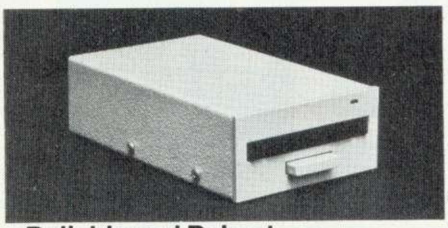
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Japan, home of the major disk drive manufacturers, has decided to make the new 3″ disks a standard. And no wonder. Not only are they strong and easily stored, they give 100K per side, and you simply flip them over in the same way as a music cassette. The small light on the casing reminds you which side you are using.

The disk is totally encased in rigid plastic, with no exposed surfaces, is easily inserted with one hand and simply removed by pressing the eject button.

A unique feature of the new disks is a mechanical tab which prevents overwriting of precious data. And of course, you can switch it back when necessary.



Reliable and Robust

The Hitachi drive boasts a brushless direct drive motor, the best possible system for trouble-free use. AMS-3 units simply run off the BBC power supply–they don't need their own supply and there's no need to worry about corrupt data.

The standard interface lets you use the disk drive with most other computers and in tandem with 5¼″ drives.

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The disk drive provides a track-to-track access time of only 3mS, much faster than old-fashioned drives.

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Please send me by door-to-door courier:

______(qty) AMS-3 (S) single disk drive at £225 each with free disk.

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THE MAGIC OF RECURSION

Jim McGregor and Alan Watt lift the mystery surrounding recursion with graphics and the Towers of Hanoi

BBC Basic is the first dialect of this language to incorporate procedures and allow recursive calls. Recursion always seems a mysterious, inaccessible process only applicable to obscure problems .like finding factorials of n. Not so! Recursive techniques are important and powerful, finding major applications in artificial intelligence (eg game playing and robotic control), language processing (compilers and interpreters) and computer graphics.

Here, we will explain the ubiquitous Towers of Hanoi program that appears in the *User Guide*; show how a program can draw a map of solutions to the Towers of Hanoi, and introduce the intriguing world of recursive graphics. In a later article we will look at practical applications of recursion.

A recursive process is one that is 'described in terms of itself'. How can this be so? One of our students recently remarked that writing a recursive program seemed like an act of faith. Many human problems solving activities are recursive in nature. For example, consider planning a route through London from the *Acorn User* office in Bedford Square to the Cunard Hotel in Hammersmith. One way might be to pick an intermediate landmark such as Marble Arch and break the original problem down into getting from *Acorn User* to Marble Arch and then from Marble Arch to the Cunard. A problem of navigation has been broken down into two easier sub-problems of navigation.

This is the essence of recursion. The solution to a problem is described in terms of solutions to easier or smaller versions of the same problem. We could (rather fancifully) describe how to map our route as follows:

```
10 DEF PROCfind_route_
     between(a, b)
20 IF getting from a to b is
     'easy' (one street say)
     THEN PROCprint_route(a, b):
     ENDPROC
30 m = a point midway between
     a and b
40 PROCfind_route_
     between(a, m)
50 PROCfind_route_
     between(m, b)
60 ENDPROC
```

We shall not expand this into a complete program, but the outline procedure describes a process with which we are all familiar. It also exhibits the essential features of a recursive procedure.

When a procedure is called, the particular problem to be considered is specified by means of its parameters:

```
PROCfind_route_between
  ("ACORN USER", "CUNARD
  HOTEL")
```

The first thing the procedure does is decide whether the problem represented by its parameters can be solved directly without breaking it down further. If this can be done, no recursion takes place. This is essential, otherwise the process would never stop.

Finally, if the problem to be solved by the call of the procedure is not easy, it is broken down into easier subproblems and the procedure requests a solution to each of these in turn. The solutions to the subproblems are requested by calling the same procedure, but with different parameters. You might find it easier to think of the subproblem being solved by different copies of the procedure, although it does not happen this way inside the computer.

Using recursion successfully means learning to recognise when a problem can be broken down into easier, or smaller, versions of itself and remembering to start a recursive procedure with a test that recognises when a given problem does not need to be further broken down. It is usually easier to write a recursive procedure without worrying in detail about what the exact sequence of operations will be when the procedure is called (an 'act of faith' if you like). Just remember the two ingredients – the stopping condition and the breakdown into easier subproblems.

It is of course interesting to understand what does happen when we call a recursive procedure. In fact, when a program does not work as intended, such understanding is essential. Later, we shall explain in detail how recursive programs work, but first let us write some simple programs that use recursion.

Many programs presented in this section could be written without recursion using loops. However, such 'inappropriate' use of recursion provides a useful introduction using familiar problems.

The first example simply prints the positive integers from 1 to n using a procedure shown in program 1. We can break down the process of printing the numbers up to n into the problem of printing the numbers up to n-1 followed by the use of a print statement to print n. If n = 0, there are no values to be printed and this condition is used to terminate recursion.

An interesting variation on this program is to change it so that it prints the integers up to n, but in reverse order. In this case, the

```
 10  INPUT n
 20  PROCprintupto(n)
 30  END
100  DEF PROCprintupto(n)
110    IF n = 0 THEN ENDPROC
120    PROCprintupto(n-1)
130    PRINT n
140  ENDPROC
```

Program 1. Prints positive integers from 1 to n

```
100  DEF PROCprintupto(n)
110    IF n = 0 THEN ENDPROC
120    PRINT n
130    PROCprintupto(n-1)
140  ENDPROC
```

Program 2. Prints positive integers from 1 to n in reverse order

breakdown into an easier sub-problem gives:

PRINT n
print numbers up to n-1 in
reverse order

The only change that needs to be made to the previous program is to switch lines 120 and 130 (program 2).

The first two programs are examples of what is sometimes called 'unary recursion' – a problem is broken down into one easier version of itself together with straightforward operations such as PRINT.

A simple example of 'binary recursion', where a problem is broken down into two simpler version of itself, is provided by an alternative approach to printing the first n integers. We can define a procedure that prints the integers in a given range. For example,

PROCprintbetween(3,7)

will print 3, 4, 5, 6, 7

PROCprintbetween(4,4)

will print the single integer 4. This procedure could be used to print the positive integers up to n by calling

PROCprintbetween(1,n)

PROCprintbetween can be defined using binary recursion if we break down the problem of printing a given sequence as follows:

print the first half of the
sequence
print the second half of the
sequence

If only one value is to be printed, this breakdown will not be needed (program 3). It is vital when writing recursive programs that variables should be declared local wherever appropriate.

```
 10  INPUT max
 20  PROCprintupto(max)
 30  END

100  DEF PROCprintupto(n)
110    PROCprintbetween(1, n)
120  ENDPROC

130  DEF PROCprintbetween(i, j)
140  LOCAL mid
150    IF i=j THEN PRINT i : ENDPROC
160    mid = (i+j) DIV 2
170    PROCprintbetween(i, mid)
180    PROCprintbetween(mid+1, j)
190  ENDPROC
```

Program 3. Illustrates binary recursion

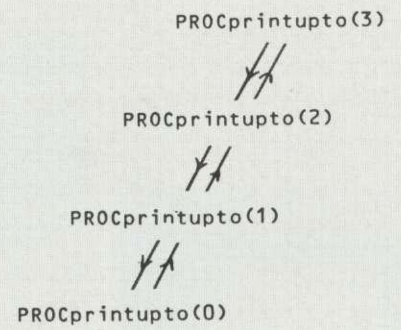


Figure 1. Tree of procedure calls for program 1

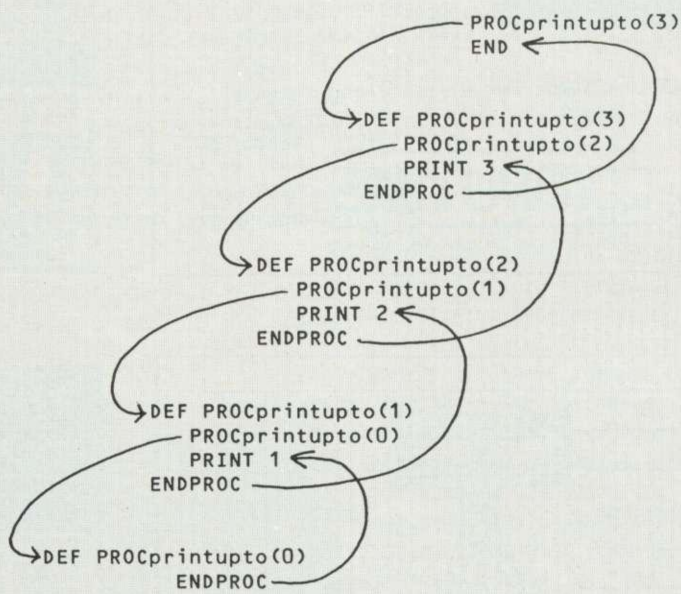


Figure 2. Detailed behaviour of program 1

Now return to program 1. We can illustrate the behaviour of this program for a call of PROCprintupto(3) by the 'tree' of procedure calls in figure 1. (The tree has only one branch at each level because we are using unary recursion.) PROCprintupto is called at several points with a different parameter each time. The only difference is that successive calls of PROCprintupto take place *before* the previous call has finished. The easiest way to understand what is happening is to imagine a separate copy of the procedure being created each time it is called. Of course, copying would be extremely wasteful and recursion is organised much more efficiently behind the scenes. Only the storage space for parameters and local variables need be copied when a procedure is called. However, in appreciating how a recursive procedure works, it is convenient to imagine the whole procedure being copied. We shall refer to these copies of a procedure as 'activations'. We can expand the above tree of procedure calls in more detail (figure 2).

Now consider the behaviour of PROCprintbetween, the procedure that used binary recursion. In this program, a call of PROCprintupto(5) results in a call of PROCprintbetween(1,5).

This executes the following:

mid = (1+5) DIV 2   ie mid = 3
PROCprintbetween(1,3)
PROCprintbetween(4,5)

Each of the two recursive calls of PROCprintbetween behave in a similar way and figure 3 is the tree of procedure calls that takes place. Follow the arrows through this tree and see exactly how the sequence of procedure calls results in the numbers being printed as required.

Note the importance of declaring 'mid' to be local to PROCprintbetween. This results in each recursive call of the procedure having its own private variable called 'mid'. Changing the value of this does not effect the current value of 'mid' in

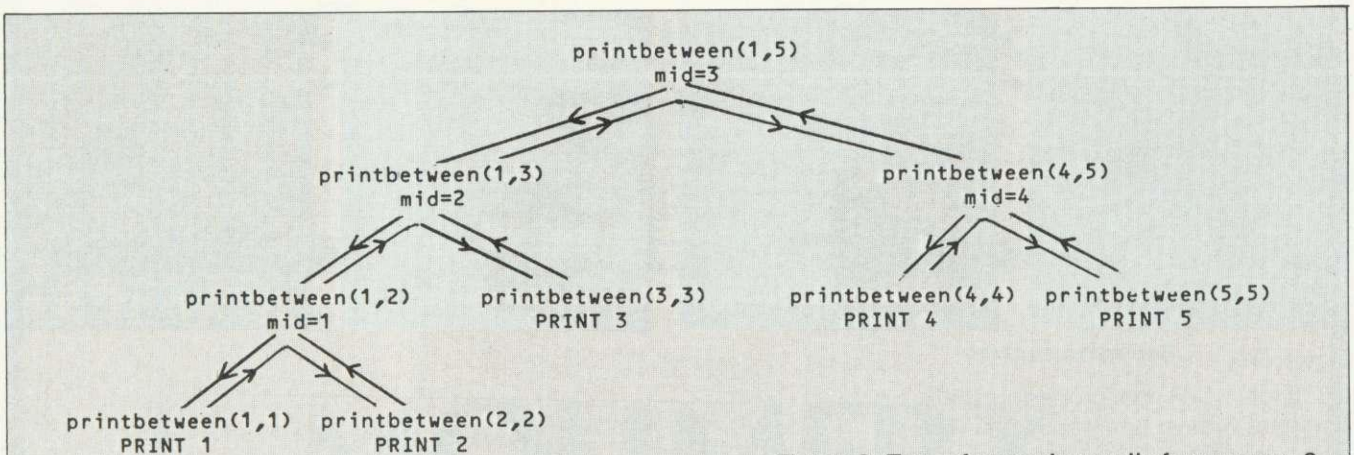


Figure 3. Tree of procedure calls for program 3

other activations or copies of the procedure.

The classic 'Towers of Hanoi' puzzle has been used as an illustration of recursion in the *User Guide*, but without explanation (p329). The puzzle consists of three (or more) pegs mounted on a base together with a number of discs, all of different diameter. The discs have holes which allow them to be slipped on and off the pegs. The initial state is as shown in figure 4. The problem is to find a sequence of moves that transfers the piles of discs from PEG1 to PEG2 subject to the following rules:

- only one disc can be moved at a time;
- no disc can ever rest on a disc smaller that itself.

PEG3 can be used during the transfer as a temporary resting place for discs.

Here is a solution to the three disc problem:

Move DISC 1 from PEG 2 to PEG 3
Move DISC 2 from PEG 1 to PEG 3
Move DISC 1 from PEG 2 to PEG 3
Move DISC 3 from PEG 1 to PEG 2
Move DISC 1 from PEG 3 to PEG 1
Move DISC 2 from PEG 3 to PEG 2
Move DISC 1 from PEG 1 to PEG 2

To produce a recursive procedure for the problem we can reason as follows. At some stage during the solution, we must move DISC3 (the largest from PEG1 to PEG2. To do this, all other discs must be out of the way on PEG3. Thus, we must first solve the easier problem of transferring two discs to PEG3 (using PEG2 as a spare if necessary). While this subproblem is being solved, DISC3 can be treated as part of the fixed base. After this subproblem has been solved, and DISC3 has been moved to PEG2, we need to transfer the two discs on PEG 3 to PEG2, DISC3 again being treated as part of the base (figure 5). Hence to transfer a tower of n discs from one peg to another peg given a spare peg:

- first transfer a tower of n-1 discs from the 'from peg' to the spare peg using the 'to peg' as a spare;

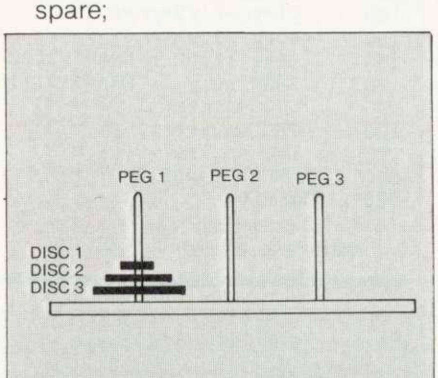


Figure 4. Towers of Hanoi

- then move disc n to the 'to peg';
- transfer the tower of n-1 discs from the spare peg to the 'to peg' using the 'from peg' as a spare.

This can be implemented directly as a Basic procedure (program 4).

Many complex patterns and curves can easily be drawn recursively and the technique is a useful tool in computer graphics and computer generated art. The simplest recursive pattern is one in which a basic shape is drawn together with recursive copies of smaller versions of the complete pattern. For example, program 5 creates a pattern of recursive squares. The pattern consists of a square, together with a recursive half-size copy of the complete pattern centred on each corner of the main square. Program 5 generates our first set of photographs which show the three stages in the build-up for r = 192, together with the complete pattern. For example, the first illustrates the

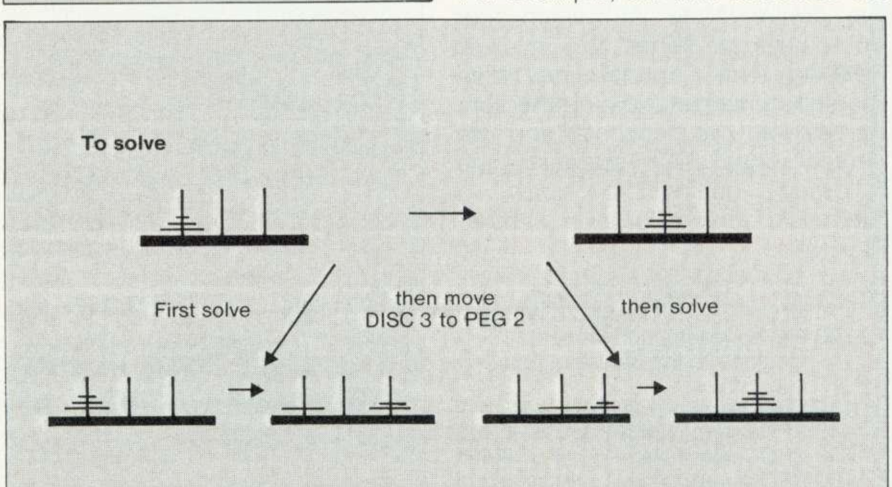
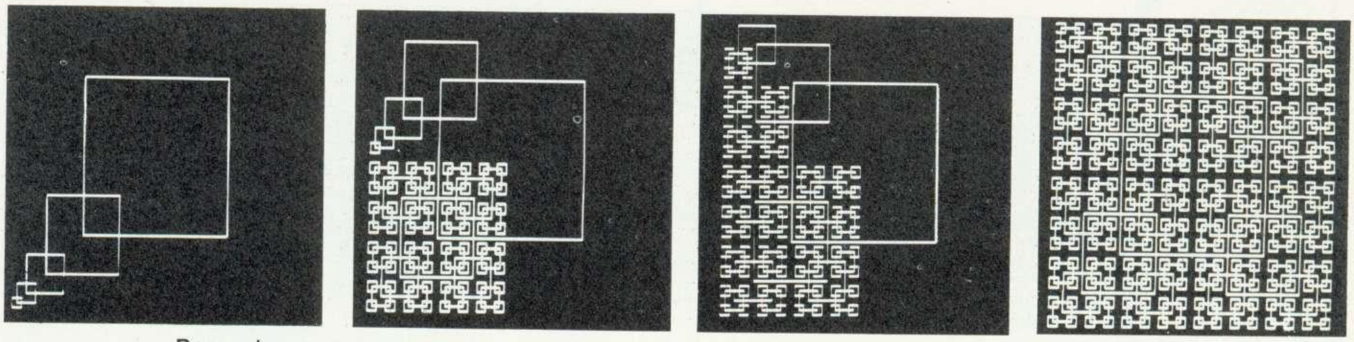


Figure 5. Solving basic problem



◀ page 36 **Recursive squares**

situation when the procedure calls in figure 6 have been activated. The last procedure call triggers the stopping condition (r<10) and does not draw a square.

At the stage reached in the second photograph, the tree of procedure calls that has been obeyed and terminated, together with the procedure calls that are still active, has the shape shown in figure 7. (Active calls are down the right.)

A large variety of patterns come into the category of 'space filling curves'. These are such that they can usually be drawn as a single continuous line or curve in some well defined way. We shall illustrate the technique using 'Sierpinski curves'.

The second set of photographs shows the Sierpinski curves of orders 1 to 4. It is convenient to define a Sierpinski curve of order 0 which consists of a diamond (figure 8).

The Sierpinski curve of order 1 consists of four order 0 curves joined at the centre. Similarly, the order 2 curve consists of four order 1 curves joined at the centre. In general, an order n curve consists of four order n-1 curves joined at the centre. Note that when four sub-curves are joined, this involves deleting four diagonal lines from the sub-curves and joining the sub-curves with two horizontal and two vertical lines. This suggests the following outline to draw a Sierpinski curve of order n, centred at (x, y):

```
100 DEF PROCsierpinski(n,x,y)
110 IF n = 0 THEN draw a diamond
120 k = horizontal and vertical
      distance to the centre of four
      sub-curves
130 PROCsierpinski(n-1, x-k, y-k)
140 PROCsierpinski(n-1, x-k, y+k)
150 PROCsierpinski(n-1, x+k, y+k)
160 PROCsierpinski(n-1, x+k, y-k)
170 ENDPROC
```

▶ page 55

```
 10  INPUT"Number of discs",noofdiscs
 20  PROCtransfer(noofdiscs,1,2,3)
 30  END
100  DEF PROCtransfer(n,frompeg,topeg,sparepeg)
110    IF n=0 THEN ENDPROC
120    PROCtransfer(n-1,frompeg,sparepeg,topeg)
130    PRINT "Move DISC ";n; " from PEG ";frompeg;
          " to PEG ";topeg
140    PROCtransfer(n-1,sparepeg,topeg,frompeg)
150  ENDPROC
```

Program 4. Towers of Hanoi solution

```
 10  INPUT "radius",r
 20  MODE 1
 30  PROCsquare(640,512,r)
 40  k=GET:MODE 7
 50  END

100  DEF PROCsquare(xc,yc,r)
110  IF r<10 THEN ENDPROC
120  LOCAL x1,x2,y1,y2
130    x1=xc-r:x2=xc+r
140    y1=yc-r:y2=yc+r
150    MOVE x1,y1
160    DRAW x1,y2 : DRAW x2,y2
170    DRAW x2,y1 : DRAW x1,y1
180    PROCsquare(x1,y1,r/2)
190    PROCsquare(x1,y2,r/2)
200    PROCsquare(x2,y2,r/2)
210    PROCsquare(x2,y1,r/2)
220  ENDPROC
```

Program 5. Recursive squares

```
            square(640, 512, 192)
                   /
          square(448, 320, 96)
                 /
        square(352, 224, 48)
               /
      square(304, 176, 24)
             /
    square(280, 152, 12)
           /
  square(268, 140, 6)
```

Figure 6. First six procedure activations for program 5

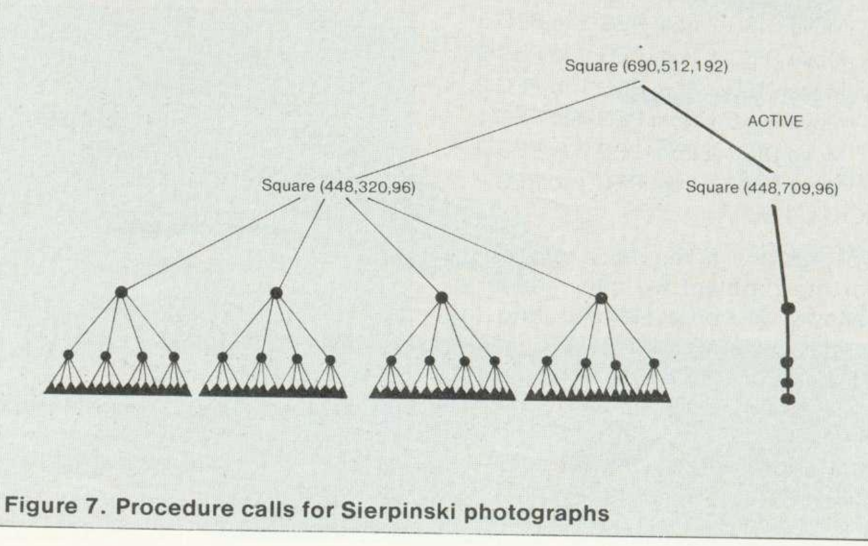


Figure 7. Procedure calls for Sierpinski photographs

Software News

INNOVATIVE
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MOLIMERX EXPANDS INTO THE BBC!

Bexhill — June 1983

TODAY a spokesman for Molimerx Ltd., the TRS-80 Genie Software House of Bexhill, announced that they are entering the BBC Software market.

Until now, Molimerx have been supplying software for all of the Tandy machines plus all of the Genie microcomputers, some dozen machines in all. As they have been doing this for some 5 years, they have accumulated a vast number of programs — in the range of 400-500 in number. Molimerx will be translating all of their best existing programs together with publishing new programs specifically written for the BBC. They are hoping, therefore, to be releasing around six new programs per month for some time to come.

Their spokesman said today that where programs are going to be translated, the features unique to the BBC will be utilised to the maximum. Specifically Molimerx say that translations will not just be a code adaptation, but will also incorporate BBC features. They gave as an example the recently completed translation of Shuttle. This is a simulation of the Columbia space shuttle. In the TRS-80 version it is displayed in straight text. The BBC version, however, contains a coloured graphic representation of the ship.

The spokesman said that the main thrust will be towards new programs and Molimerx are actively soliciting new software from both their existing stable of 120 authors and are also searching for new qualified authors, experienced on the BBC machine.

Over the years, Molimerx have built up a catalogue of some 170 pages. The procedure is that an addition containing new software is published every 8 weeks or so. The existing index is discarded and the new addition contains a new up-dated index. The catalogue is punched for a ring binder; hence, customers always have a current and up to date catalogue. Molimerx say that this same procedure will be used for the new BBC software catalogue.

Owners of BBC machines, therefore, should write to Molimerx for a copy of their current catalogue. For at least a while, there will be no charge. Customers should send an A4 size stamped addressed envelope for 17p.

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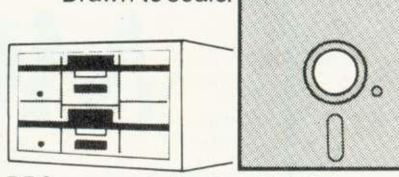
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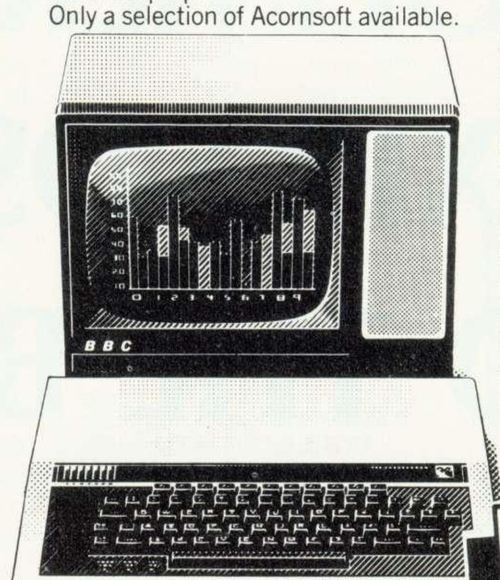
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THE SECRETS OF HANDLING ARRAYS

Ian Copestake explains how the Beeb uses strings and arrays in memory

If you live on huge arrays and long strings, you need to know just how they are handled in the memory: but the *User Guide* will not tell you. So here is a guide to BBC variables.

Let's look at the program itself. The address of the first program byte is given by PAGE. This can be changed by the user, but is &0E00 (unless you have discs, etc). Each program line consists of four bytes, followed by the text of the line. The four bytes are: &0D; high byte of line number; low byte of line number; length of line.

The last program line is followed by &0D, &FF. In fact these two bytes are present even when there is no program; thus the value of TOP, which points to the byte after the &FF, is always at least two more than PAGE. LOMEM is normally the same as TOP, and marks the first byte of the variables store. Locations &0002,03 give the low and high bytes of the address, which I'll call VARTOP, of the 'next free byte' in store.

For this article, I've divided variables into three categories: simple variables; arrays; functions and procedures. Figure 1 shows, in a modular fashion, the structure of each category when stored in the memory. The number under the module shows how many bytes it occupies.

Now for a description of each module. NE (Next, two bytes). These two locations give the low and high bytes of the address of either (a) the next variable whose name begins with the same character, or (b) the next function or procedure (whatever its name begins with). The high byte is reset to zero if there is no such next variable.

NA (Name, zero or more bytes) is made up of the ASCII code for:

- the first letter of the name, only if it is a function or a procedure, plus
- the rest of the name (if any), plus
- '%' for an integer numeric variable, plus
- '$', for a string variable, plus
- '(', for an array.

Thus the first letter of the name of a simple variable or array is not stored here: a real (floating point) variable called A will have no NA module at all.

00 (Zero), is a single byte containing the value zero.

VA (Value, four or five bytes) has three forms (figure 2). In the first form, real numeric, the exponent byte is followed by four mantissa bytes. Bit 7 of the first mantissa byte gives the sign of the number.

Next there is integer numeric. This has four bytes, the first being the least significant.

Finally, the string form. TE gives the low and high bytes of the address where the text of the string is stored. When a simple string variable is first created, the text will follow the VA module; but, as we will see later, it may not stay there for long. RE is the number of bytes reserved for the text of the string. LE is the current length of that text, and may be less than RE.

In an array, the form of the VA module will of course depend on the form of the array. If the array has 50 elements, 50 VA modules will be stored right from the start; but no actual text space is reserved for a string array by the DIM statement (in other words all REs and LEs will be zero). The element numbers of the VA modules in an array run in the order (0,0) (0,1) . . . (1,0) . . and so on.

HE (header, one byte) indicates the number of bytes in an array header, measured from HE itself to DL, inclusive. Looked at another way, the value of HE is one more than twice the number of dimensions in the array. Since HE is a single byte, you can declare an array with up to 127 dimensions – if you're really keen!

D0 to DL (zero to last dimension, two bytes each). There is a pair

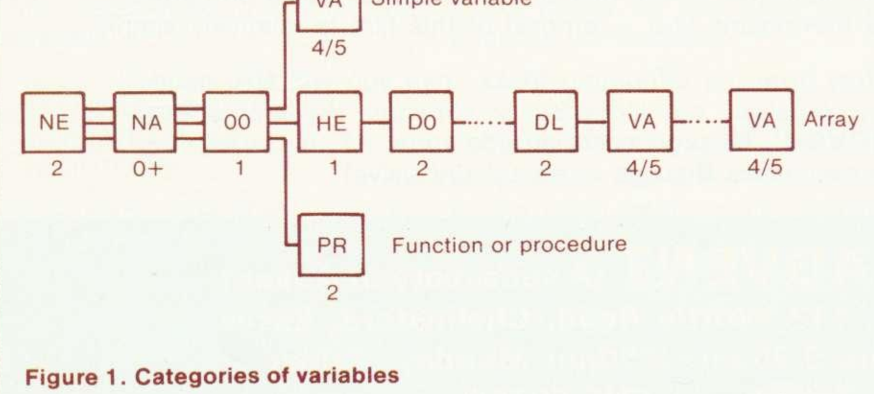


Figure 1. Categories of variables

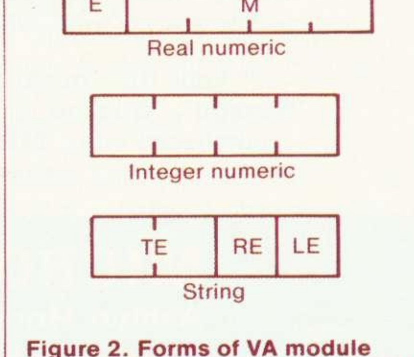


Figure 2. Forms of VA module (each square represents one byte)

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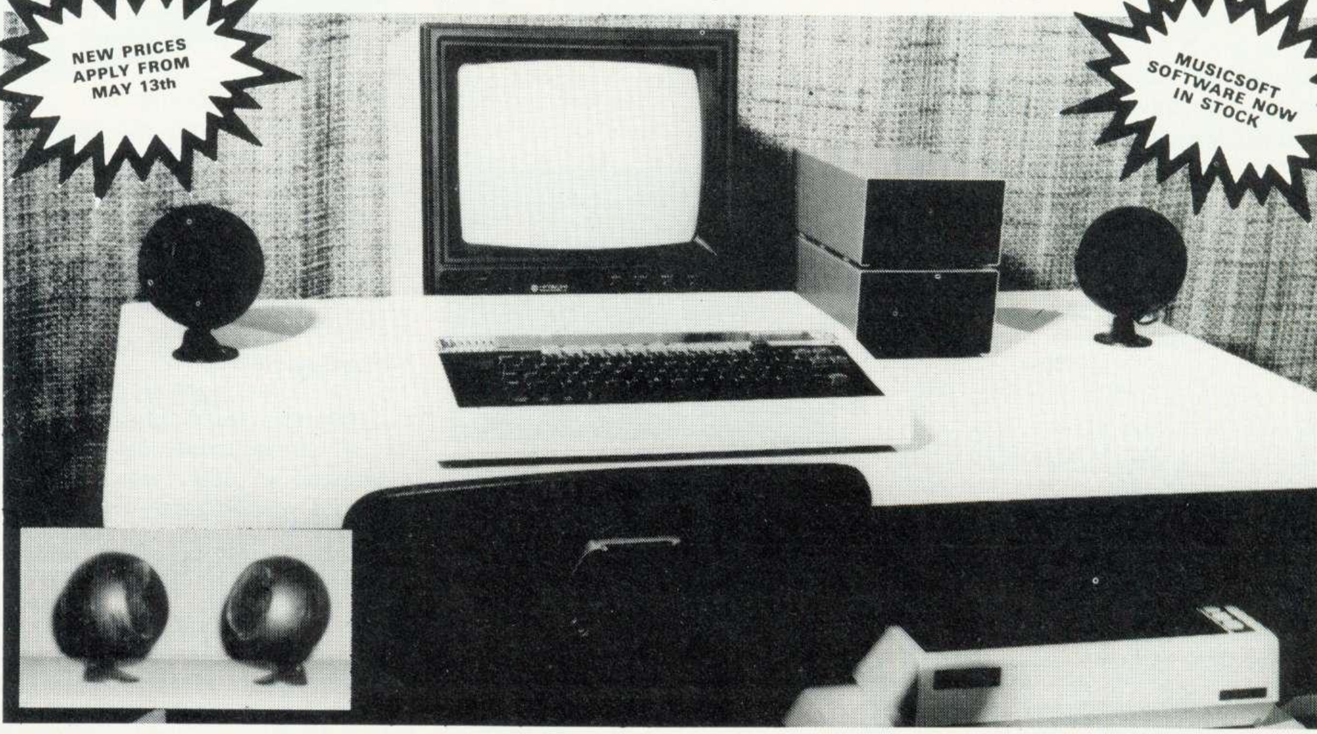
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of bytes for each dimension in the array: each pair gives the number of elements in the corresponding dimension. The first byte of the pair is less significant. For example, after DIM A$(1,1): D0 will be &02, &00; D1 will be &02, &00; HE will be &05.

PR (program, two bytes). These two locations contain the low and high bytes of the address within the program itself where the function or procedure is defined. They point to the program byte immediately following the name of the function or procedure.

The PR bytes are followed by the formal parameters, if any, and if their names have not been used earlier in the program (in which case they would already exist in the variables store). These in turn are followed by any local or other variables created within the function or procedure. Each of these parameters or variables is stored with the usual four modules for a simple variable: NE NA 00 VA. As far as the variables store is concerned, the statement LOCAL A has the same effect as LET A=0.

Variables within a function or procedure are not transferred to the store until the function or procedure is actually called.

A quick word in passing about data. This is transferred to store when it is read, so from our point of view the program:

```
10 DATA yes
20 READ Y$
```

is, when run, the same as

```
10 Y$="yes"
```

Let's look in more detail at the way the Beeb stores the text of a string, since it has a voracious appetite for RAM when doing this. Run this program:

```
10 LET A$="GLUTTONY"
20 LET A$=A$+A$
30 PRINT LEN A$
40 GOTO 20
```

The program stops when the length of A$ has doubled to 128, because the maximum length for a string is 255. However, the computer has now consumed no less than 272 bytes of variables storage space! You can check this by looking at TOP and VARTOP, and subtracting one from the other. Why does it do this? Well, it's like this.

Type CLEAR, then A$="YES" as direct commands. You have now used 11 bytes: two for NE, one for the $ in NA, one for 00, two for TE, one each for RE and LE, and three for the text itself. If you now type A$="NO", the text will be overwritten to produce "NOS". The value of LE is changed from three to two, so the computer ignores the final S. Nothing else changes.

Now type A$="PERHAPS". This won't fit into the three bytes reserved by RE; so the value of RE is altered to seven. The value of LE also changes to seven. But the computer is not clever enough to use the space occupied by 'NOS' (even though A$ is the only variable in the store). It has to start again at the next free byte, given by VARTOP: the address of the text, as stored in TE, is therefore increased by three. Your seven-character string now uses 18 bytes of memory, of which three are permanently dead. If you had started with A$="YES□□□□", you would now be using only 15 bytes to store "PERHAPS" (□ represents a space).

'The Beeb has a voracious appetite for RAM when storing strings'

But this is not the whole story! Suppose you carry out:

```
CLEAR
A$="YES"
A$="UNLIKELY"
```

How many byte are you using now, for an eight-character string? Not 16, not even 19 . . . but 27! Two for NE, one for NA, one for 00, two for TE, two for RE and LE, three for the dead "YES", eight for "UNLIKELY", and, if you can believe it, eight spare ones – which the machine has thoughtfully set aside in view of your inept programming. So while the value of LE is eight, that of RE is 16!

Every time you try to assign eight or more bytes of text to a string variable whose RE is insufficient, you get eight bytes more than you asked for. The effect is cumulative, and operates right from the start; so

```
CLEAR
A$="1234567"
```

reserves seven bytes of text space, but

```
CLEAR
A$="12345678"
```

reserves 16.

Moral: when you first assign a string, give it the maximum length it is ever likely to need; and never use eight characters if seven will do.

Careless typing costs bytes, too. If you type A$=1 when you mean A%=1, you will set up a string variable called A$. The command DIM A(6000) will produce the error message 'DIM space', because it's too big. But the NE, NA, and 00 modules will have been set up; so that if you follow on with DIM A(1) you will get a 'Bad DIM' message, because you're not allowed to re-dimension an existing array!

The operating system needs to know where it has stored each variable, and keeps a catalogue in page &04 for this purpose. Locations &0482,83 point to the first variable whose name begins with 'A'; &0484,85 indicate the first whose name starts with 'B'; . . . &04C2,C3 point to the first whose name begins with 'a'; and so on.

Locations &04F6,F7 point to the first funciton; &04F8,F9 to the first procedure.

Now you can see why the first letter of the name of a simple or array variable need not be entered in the variables store.

The catalogue is destroyed when a program listing is modified, even if the length of the program is unchanged. So even the most minor adjustment has the effect of clearing all variables except the system integers.

The system integer variables are stored near the catalogue, taking four bytes each. @% starts at

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&0400; A% at &0404; . . . Z% at &0468. The value of @% is set initially to &0A0A; and curiously enough, while P% to Z% contain zero, A% to O% have the value &FFFFFFFF (=-1), at least on my machine.

Note that the system integers do not appear in the main variables store at all.

That just leaves the function keys, whose definitions are stored in page &0B. Locations &0B00 to &0B11 (18 bytes) give the addresses, offset from &0B01, of the definitions for keys 0 to 17. In other words, the definition for key f4 starts at (&0B01 + ?(&0B04)). (Not that many keys, you say: well hang on a moment.)

Initially, all the above locations contain &11. The statement:

```
*KEY0RUN¦M
```

will (assuming this is the first key to be defined) put the ASCII codes for the letters RUN into locations &0B12,13,14; and &0D into &0B15. &0D is the code for carriage return – the equivalent of [CTL]M.

Locations &0B01 to &0B11 (that is, all except the one for key f0) are now set to &15. The next definition will begin at &0B16; and so on.

'Even minor adjustments clear all variables except the system integers'

When a key is re-defined, the new code is first tacked on the end, after all other key definitions; then the original definition is deleted by shifting everything that follows it backwards. So if you want to re-program a key and are short of function-key memory, start by resetting it to contain nothing.

Some interesting effects can be obtained with the function keys. Try this, starting with all keys undefined:

```
*KEY0HELLO,□
*KEY1HOW ARE YOU?¦M
PRINT $&B12
```

Note that though the space after 'HELLO,' is reproduced, spaces before it would be ignored.

If you are lucky enough to have an Epson MX80 printer, you may have found the delete key doesn't communicate with it; so that typing RUU[DEL]N produces 'RUUN' on the screen but 'RUN' on the paper. You can solve this by typing RUU[DEL][CTL]A[DEL]N, since [CTL] A causes the next character to be sent to the printer only. But there is a much better way! Starting with all keys empty, type the following:

```
*KEY0¦A¦A¦A (whichever key you
   prefer)
&B12=127
&B14=127
```

This key now deletes on the screen and the printer at the same time. You can even delete the command mode prompt '>' from the printer buffer (though not from the screen). In the routine above, all we have done is to overwrite two of the As with 127 (ASCII for delete).

Now for a word on those extra function keys. You can treat the break key as f10; it will still cause a break, but will then carry out whatever instructions put into it, such as OLD¦M. (Incidentally, if you use page &0B as extra RAM, be careful not to re-define the break key by accident!)

Versions of the operating system from issue 1.0 allow the user to re-program the cursor control and copy keys. It may even be possible on issue 0.10, because

```
*KEY15 PRINT "HELLO" ¦M
```

puts all the right code in memory page &0B; and *FX4,2, which is supposed to enable this programming, certainly disables the editing keys. If anyone knows how to do it, write in!

This would account for 16 keys; and it may be that location &0B11 only exists to mark the end of the definitions list.

How to pass formal array parameters to and from procedures. Turn to page 44.

The versatility of BBC Basic is demonstrated by these two utility programs

PASSING ARRAY VARIABLES

BASIC does not allow array variables to be passed as parameters to procedures or functions. It is usually necessary, therefore, to copy arrays into global variables which may be used instead. This method has drawbacks as it wastes storage space in duplicating information.

An alternative is illustrated in listing 1, which gives as example a function, FNscalarprod, which returns the scalar product of two (M%+1)-dimensional vector arrays. Names of vectors are passed in the formal string parameters P$ and Q$, and the elements of the vectors are found using EVAL. This permits FNscalarprod to be applied as shown to any compatible pair of vectors without duplication.

```
10   N%=5
20   DIM VECTOR%(N%),ARRAY(N%),MATRIX(N%)
30
40   REM choose elements
50
60   FOR J%=0 to N%
70   VECTOR%(J%)=J%+1
80   ARRAY(J%)=J%↑2
90   MATRIX(J%)=J%*(J%+1)
100  NEXT
110
120  REM we can now find some scalar
130  REM products.
140
150  CLS:PRINTTAB(8,9)"(VECTOR).(ARRAY)="
     FNscalarprod("VECTOR%","ARRAY",N%)
160
170  PRINTTAB(8,13)"(MATRIX).(VECTOR)="
     FNscalarprod("MATRIX","VECTOR%",N%) ' ' '
180
190  END
200
210
220  DEF FNscalarprod(P$,Q$,M%)
230  LOCAL I%,SUM
240  SUM=0
250  FOR I%= 0 to M%
260  SUM=SUM+EVAL(P$+"(I%)")*EVAL(Q$+"(I%)")
270  NEXT
280  =SUM
```

This method is unsuitable in the case of a procedure which is intended to return a result which is an array variable instead of a single number. Again, the problem can be solved by duplicating information in globally dimensioned arrays, but a neater solution would be to use array variables as formal parameters to the procedure, and to call the parameters by name instead of by value. Basic permits neither of these techniques, but their effects are easily simulated as illustrated in listing 2.

The example is a procedure, PROCmatrixmult, which multiplies together two (M%+1)x(M%+1) matrix arrays and places the product matrix into a suitable third array, without needing to copy any array. The names only of the three arrays are passed to the procedure as before in the formal string parameters P$, Q$ and Z$. There are restrictions on the allowable names for these arrays, however, and for simplicity, PROCmatrixmult works only with arrays whose names comprise any single upper or lower case letters except x, y and z, such as A(X%) or f(Y%), although some extensions are possible. (Actually, '£' and '_' are also permissable).

The method relies on the way variables are stored in the BBC micro. Along with the name and value of each variable is stored the address of the next variable encountered (if any) whose name begins with the same letter. Vectors at fixed locations in memory point to the first members of these lists of variables. For example, &4F0 and &4F1 point to the storage location of the first variable whose name begins with 'x'. (Beeb Forum, November 1982)

The function FNaddress (P$) returns the location of the vector that points to the first member of the list which contains the variable whose name is found in P$. PROCnewvectors then alters the vectors to the lists that contain

```
10 MODE 7
20 N%=3
30 DIM A(N%,N%),G(N%,N%),W(N%,N%)
40
50 REM choose a matrix, A
60
70 FOR I%=0 TO N%
80 FOR J%=0 to N%
90 A(I%,J%)=(I%+3)* (2*J%+1)
100 NEXT
110 NEXT
120
130 CLS:PRINT "Starting with"
140 PROCprintmatrix("A",N%)
150
160 PROCmatrixmult("A","A","G",N%)
170
180 REM Matrix G now holds
190 REM The square of matrix A.
200
210 CLS:PRINT "we can form the self-product"
220 PROCprintmatrix("G",N%)
230
240 PROCmatrixmult("G","A","W",N%)
250
260 REM Matrix W now holds the
270 REM product of matrices A and G.
280
290 CLS:PRINT "and do other manipulations," '
300 PROCprintmatrix ("W",N%)
310 PRINT ' ' "without copying arrays." ' '
320 END
330
340
350 DEF PROCmatrixmult(P$,Q$,Z$,M%)
360 LOCAL addx%, addy%, addz%,I%,J%,K%,SUM
370 PROCnewvectors
380 FOR I%=0 TO M%
390 FOR J%=0 TO M%
400 SUM=0
410 FOR K%=0 TO M%
420 SUM=SUM+x(I%,K%)*y(K%,J%)
430 NEXT
440 z(I%,J%)=SUM
450 NEXT
460 NEXT
470 PROColdvectors
480 ENDPROC
490
500 DEF PROCnewvectors
```

page 51 ▶

variables x, y and z so they now point to the lists containing the variables whose names are given in P$, Q$ and Z$, respectively. The old vectors, meanwhile, are stored in addx%, addy% and addz%. (Of course, no other variables whose name begins with x, y or z may be used within PROCmatrixmult).

In searching for the variable x, therefore, the computer will examine the list that contains the array whose name was given in P$. Because variable names are stored stripped of their initial letter, if the names of the array x and of the array indicated by P$ differ only in their initial letter, the computer will accept the latter array in place of x, thereby effecting a call by name. The contents of the array indicated by P$ can now be accessed or modified from within the procedure by referring instead to the array. Note that arrays x, y and z do not exist and need not be dimensioned.

At the end of PROCmatrixmult, PROColdvectors restores the original pointers. Finally, PROCprintmatrix prints a matrix on the screen.

This method of simulating a parameter call by name is clearly capable of handling all types of variables, but it is probably most useful with arrays. The extension to integer and string variables and arrays is straightforward (replace x, y or z by x% or x$, as appropriate) and makes this a very versatile technique.

Microware presents the latest news on BBC.



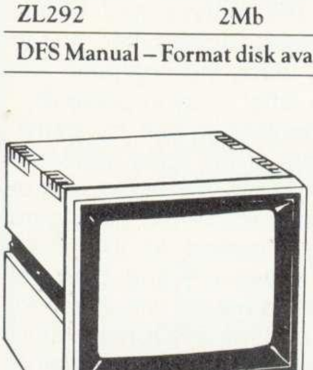
N.B. 40/80 Format Switch – call for information



Reports are coming in that Microware, the authorised dealers for BBC and Epson, are being inundated with orders and enquiries from BBC micro owners. It is believed that this unprecedented activity is the result of the wide range of products on offer and the competitive pricing policy of the company. The most dramatic recent development is the exclusive ZL range of floppy drive sub-systems.

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Further news items, of interest to BBC micro users, are the Hantarex monochrome monitors with green or amber screen options. A full range of Epson printers are available from stock, including the RX 80 at £295 and the FX 80 and MX 100. High quality Dysan and Memorex floppy diskettes start at £1.62 and are always available.



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PARADOX OF NEW BASIC

ACORN has made it clear that programs written on machines with Basic I should interchange between those with Basic II. As long, of course, as you do not use any of the new keywords! However, some people are experiencing problems with file handling using Basic I keywords.

To be specific, OPENIN doesn't seen to work properly. What happens is that a program is written and saved on a Basic II machine using OPENIN to open files when required. But when the program is loaded onto a Basic I machine, OPENIN will not apparently work.

I will first give the solution, and then the explanation. The solution is to use OPENUP and *not* OPENIN when writing programs on a Basic II machine – with cassettes.

The reason is fairly simple. OPENUP has the same token as OPENIN used in Basic I (&AD). OPENIN in Basic II has the token value &8E, not used in Basic I. It follows (as explained in last month's Forum) that OPENIN in Basic I gives the same random access facilities as OPENUP in Basic II.

So, you need to get out of the habit of using OPENIN on the latest machines. And the paradox is: you can only get consistency in file handling if you use a keyword which exists in Basic II but not Basic I! (Acorn did it this way to allow Basic I programs to transfer to Basic II.)

IAN BIRNBAUM sets out to improve your programming techniques on the BBC micro.

He will answer reader's questions in this column and develop their ideas – as well as giving some of his own. But the real aim is for readers to provide the questions and the answers.

At least £5 will be paid for any tip published, with £10 for those which merit a one-star award and £20 for real humdingers!

The idea must be original and be described clearly and fully. It should not have been published before.

Your contribution should be typed or printed, with any substantial listings on cassette, but only included to make a point.

Send your hints or questions to BBC Forum, Acorn User, 53 Bedford Square, London WC1B 3DZ. Please include a self-addressed envelope if your contribution is to be returned. We cannot answer letters individually, but a cross-section of common and interesting points will be covered.

IMPROVEMENTS TO MACHINE CODE DISC SHIFT

£5

READERS who use the machine code listing to relocate a program in memory on disc machines may have had problems (February, Forum). However, P. Chilvers from Sponne School in Towcester has made several improvements (listing 1). Changes in lines 32080, 32160 and 32000 allow a change of PAGE immediately after *TAPE. This, with NEW in the keyboard buffer, resets pointers more safely than before.

Most important though is the use of RTS to return to Basic, as the old method corrupts the shifted program and/or doesn't allow the programmed *KEY10 and break to reload, shift and run the program more than once. This version also works with Basic II.

The changes to the original listing in February's issue are extensive and so we have printed a complete new listing.

See February's *Acorn User* (page 24, 25) for a more detailed explanation of the program.

Listing 1.

```
    0GOTO32000
32000BASE=&70:OLDLOC=&
     72:NUMBER=&74:
     ?&76=?&18
32010FORI%=0 TO 2
     STEP2:P%=&C00
32020[OPTI%
32030LDA &12
32040SEC
32050SBC #9
32060STA NUMBER
32070LDA &13
32080SBC &76
32090STA NUMBER+1
32100LDA #0
32110STA BASE
32120LDA #&0E
32130STA BASE+1
32140LDA #9
32150STA OLDLOC
32160LDA &76
32170STA OLDLOC+1
32180LDY #0
32190LDX NUMBER+1
32200BEQ LOLOOP
32210.LOOP1
32220LDA (OLDLOC),Y
32230STA (BASE),Y
32240INY
32250BNE LOOP1
32260INC OLDLOC+1
32270INC BASE+1
32280DEX
32290BNE LOOP1
32300.LOLOOP
32310LDX NUMBER
32320BEQ FINISH
32330.LOOP2
32340LDA (OLDLOC),Y
32350STA (BASE),Y
32360INY
32370DEX
32380BNE LOOP2
32390.FINISH
32410RTS:]NEXT
32420*FX138,0,78
32430*FX138,0,69
32440*FX138,0,87
32450*FX138,0,13
32460*FX138,0,79
32470*FX138,0,76
32480*FX138,0,68
32490*FX138,0,13
32500*FX138,0,82
32510*FX138,0,85
32520*FX138,0,78
32530*FX138,0,13
32540*TAPE
32550PAGE=&E00
32560HIGH=TOP-777:
      HIGH?-1=&FF
32570CALL&C00
```

ROBERT WARD AND RICHARD PHILLIPS FROM HULL UNIVERSITY CREATE FILES WHICH BEHAVE LIKE PROGRAMS

£10

THE following method creates a single program file which can be loaded, run and saved like a normal single program provided *SAVE is used. The data is poked into memory above the program, and program plus data are saved together using *SAVE. When the variables are dimensioned normally and the data is read into them from high memory.

Suppose for example we have a 6k program which runs in mode 1 (about 8700 bytes left). Suppose also the program uses 2k of data consisting of 200 strings totalling 1200 bytes and 200 integers totalling 800 bytes.

First write a file-making program using DATA statements (ie, read each item and save it on tape using OPENOUT and PRINT#). Then run this program to create the tape file.

Program *KEY0 by typing listing 1 in the command mode. When KEY0 is used the data file will be poked into the memory space just above the program.

Alter the main program so the coding of listing 2 is executed first. This copies the data to the space above himem. In mode 2 this is part of the video RAM but it is available in mode 7, where we are for now.

Also in the main program dimension the variables in the normal way. Listing 3 shows this for the example, and also shows the coding which transfers the data back from high memory into the dimensioned variables. These lines should also appear in the main program. After this process mode 1 is called.

When the alterations to the main program are complete, set up the cassette recorder ready to play back the data file. Then press KEY0. When the operation is finished the number of the highest byte poked plus 1 is printed out.

Save the whole thing using:

SAVE "Progname" E00 XXXX

where XXXX is the number printed out at the end of the previous step. Thus all bytes from PAGE up to XXXX are saved. The program as saved can be loaded and run in the normal way. To make a copy the program must be loaded and saved straight away using SAVE.

Listing 1

```
*KEY0A%=TOP+50:X=OPENIN("filename"):FORI%=1TO200:
INPUT X, j$,J%:$A%=j$:A%=A%+LEN(j$)+1:!A%=J%:A%=A%+4:
NEXT:CLOSE X:PRINTA%
```

Listing 2

```
MODE7
HIMEM=HIMEM -2050
A%=HIMEM
FORI%=TOP TO TOP+2050 STEP4
   !A%=!I%
   A%=A%+4
NEXT
A%=HIMEM+50
```

Listing 3

```
DIM strings$(200),integers%(200)
FORI%=1TO200
   strings$(I%)=$A%
   A%=A%+LEN(strings$(I%))+1
   integers%(1%)=!A%
   A%=A%+4
NEXT
MODE1
```

CASSETTE AND DISC BACK-UPS

THERE seems to be some confusion over creating backups for cassette and disc files. It is, in fact, easy to do this using *LOAD and *SAVE. Let us suppose we wish to create a tape backup of a file called File which is on tape. Whether it is data, machine code or program is irrelevant. Type:

*LOAD "FILE" 0E00

and the file will load. Note the message when it has finished. Suppose it reads

FILE 05A0

Type

*SAVE "FILE" 0E00 +5A0 0 0

and save the file to the backup tape.

The same technique can be used to transfer a file from tape to disc or vice versa. In this case, use 1900 instead of 0E00.

NOTE that the disc operating system will not differentiate between lower and upper case. Therefore writing SAVE "PROGRAM" followed later by SAVE "program" will result in the first file being erased.

This is a common technique for title pages on cassette, but a different idea needs to be used for disc. The easiest method is to put the main program in a different directory from the title page. Thus SAVE "PROGRAM" for the title page and SAVE "M.PROGRAM" for the main program. Running PROGRAM can then chain M.PROGRAM.

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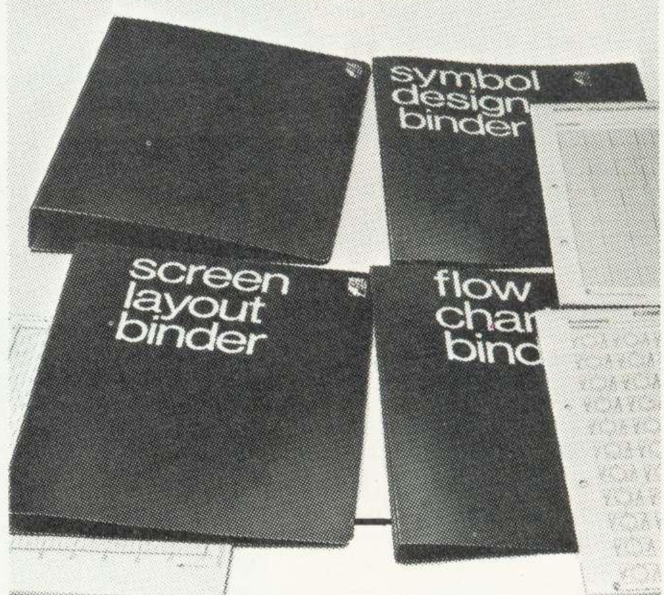
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J. DOGGETT DELVES INTO THE MURKY WORLD OF *FX CALLS

THE world of *FX commands seems to be growing daily. The additional list in May's *Acorn User* is definitely not the end of the matters, as shown by the appearance of *FX209 in the last issue. Mr. J. Doggett of Leicester earns a fiver for delving into *FX255.

This call reconfigures the start up mode and boot options:

*FX255,0	selects mode 0 on a simple break and boots disc
*FX255,1	selects mode 1, etc
*FX255,7	selects mode 7, etc
*FX255,8	selects mode 0, no auto boot
*FX255,15	selects mode 7 etc. A 'hard break' (CTRL-break on 1.0 onwards) resets to the default case.

Mr Doggett has spotted *FX202,32,207 in a listing. What does this do?

PRINTER DRIVER

THE *FX5,3 command is used if you wish to provide your only printer drive for a particular machine. It has been suggested to me that it does not work. However, it does, since after executing *FX5,3, the computer will indirect through address &222,&223. This contains by default the null output address; this is why nothing seems to happen. Change its contents to another address, however, and the effect will be obvious. Of course, to use it properly you will need to write your own routine: put it at &C00 say, and put zero in &222 and 12 in &223.

£5

DAVID BALL FROM SKELMERSDALE DISABLE ESCAPE KEY IN OS 0.1

I WAS interested to read Ian Copestake's article in April's Beeb Forum dealing with the problem of disabling the escape key under operating system 0.1.

Here is my solution which can be placed inside a program to disable the escape key type:

?&226 = &FF

In fact putting any value other than 0 (zero) into memory location &226 will disable the key completely.

To enable the escape key type:

?&226 = &0 (zero)

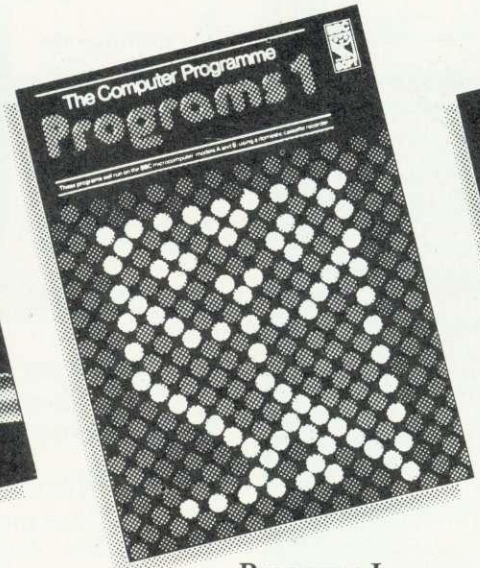
and everything is back to normal.

▶page 45

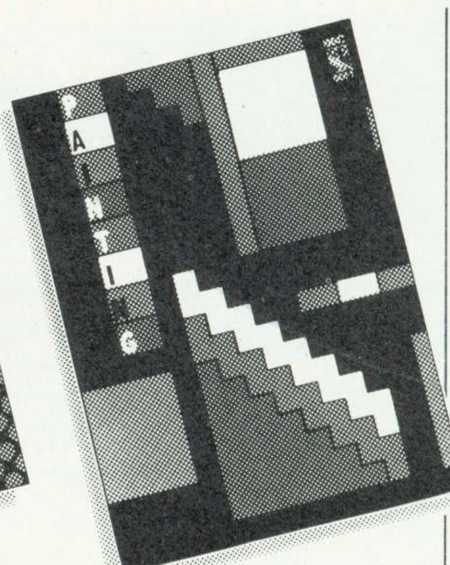
```
510 addx%=?&4F0 + 256*?&4F1
520 addy%=?&4F2 + 256*?&4F3
530 addz%=?&4F4 + 256*?&4F5
540 I% = FNaddress(P$)
550 J%=FNaddress(Q$)
560 K%=FNaddress(Z$)
570 ?&4F0=?I% : ?&4F1=I%?1
580 ?&4F2=?J% : ?&4F3=J%?1
590 ?&4F4=?K% : ?&4F5=K%?1
600 ENDPROC
610
620 DEF PROColdvectors
630 ?&4F0=addx%MOD256 : ?&4F1=addx% DIV 256
640 ?&4F2=addy%MOD256 : ?&4F3=addy% DIV 256
650 ?&4F4=addz%MOD256 : ?&4F5 = addz% DIV 256
660 ENDPROC
670
680 DEF FNaddress(A$)
690 IF ASC(A$)>119 THEN PRINT ' "Parameters may not start with x, y or z.": END
700 =2*ASC(A$)+1024
710
720 DEFPROCprintmatrix(P$,M%)
730 LOCAL I%,J%
740 PRINTTAB(4,5) "Matrix  "; P$
750 P$=P$+"(I%,J%)"
760 FOR I%=0 TO M%
770 FOR J%=0 TO M%
780 PRINTTAB(10*J%,3*I%+8) EVAL(P$)
790 NEXT
800 NEXT
810 G$=INKEY$(300)
820 ENDPROC
```



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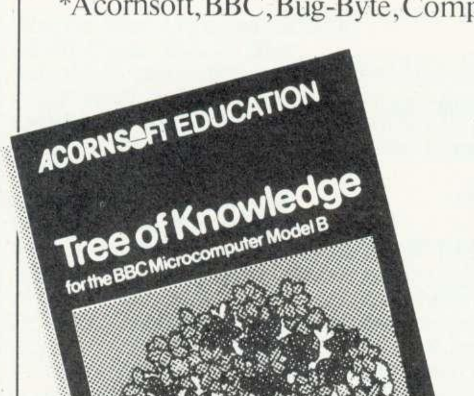
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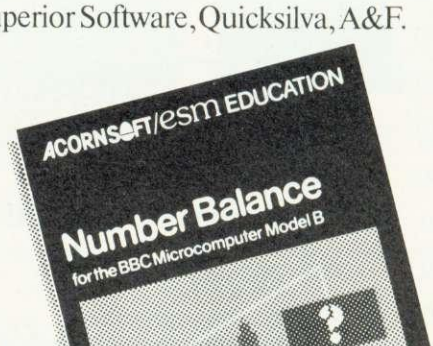
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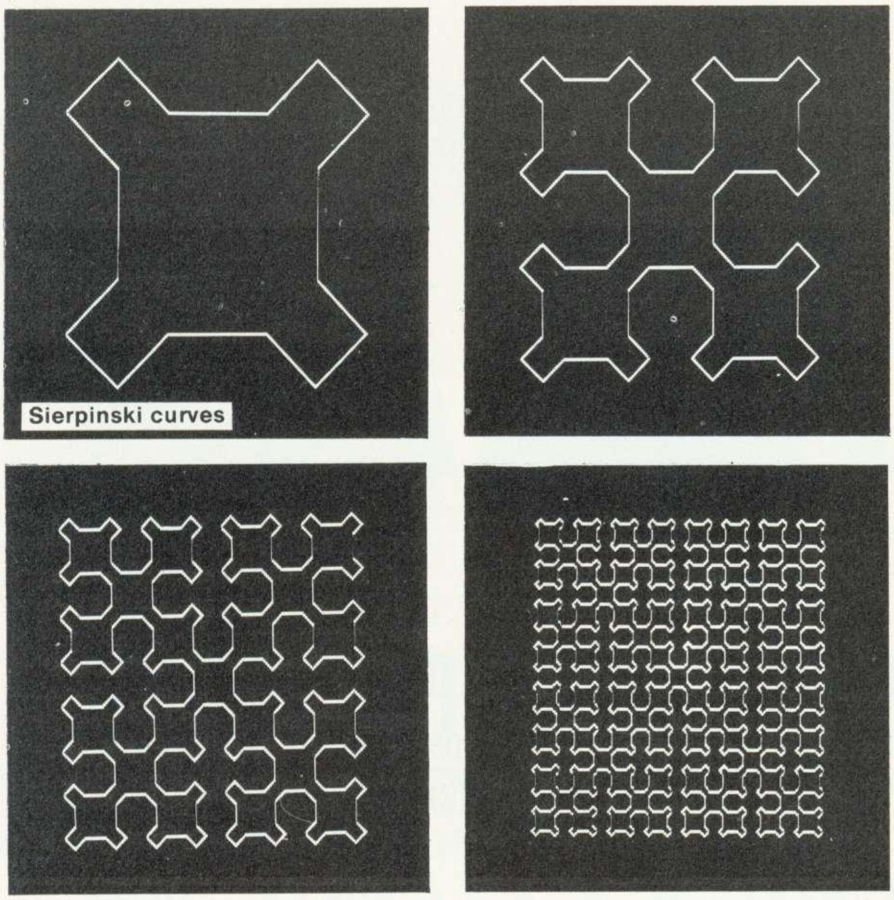
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Sierpinski curves

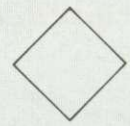


Figure 8. Sierpinski curve, order 0

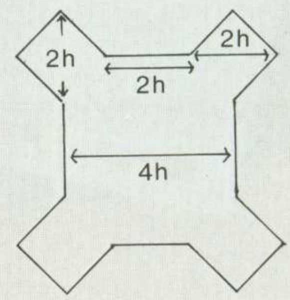


Figure 9. Dimensions

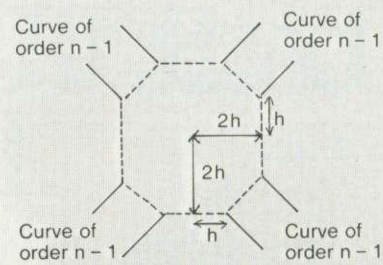


Figure 10. Curves and sub-curves

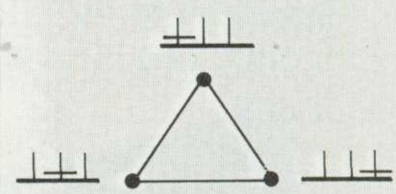


Figure 11. Towers – three one-disc problem states

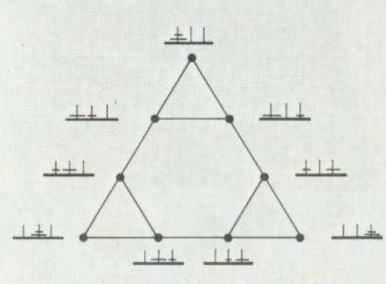


Figure 12. Towers – nine two-disc problem states

```
 10  INPUT"Order",order
 20  size=(2^order-1)*4+2
 30  h=INT(600/size)
 40  h2=h*2
 50  MODE 0

100  PROCsierpinski(order,640,512)
110  k=GET:MODE 7
120  END

130  DEF PROCsierpinski(n,x,y)
140  LOCAL k
150    IF n=0 THEN MOVE x-h,y:DRAW x,y+h:
     DRAW x+h,y: DRAW x,y-h:DRAW x-h,
     y:ENDPROC
160    k=2^n*h
170    PROCsierpinski(n-1,x-k,y-k)
180    PROCsierpinski(n-1,x-k,y+k)
190    PROCsierpinski(n-1,x+k,y+k)
200    PROCsierpinski(n-1,x+k,y-k)
210    MOVE x-h2,y-h
220    PLOT 9,0,h2 : PLOT 11,h,h
230    PLOT 9,h2,0 : PLOT 11,h,-h
240    PLOT 9,0,-h2 : PLOT 11,-h,-h
250    PLOT 9,-h2,0 : PLOT 11,-h,h
260  ENDPROC
```

Program 6. Sierpinski curves

To fill out this procedure, we need to examine the geometrical details fairly carefully. Any curve of order 1 or more consists of repeated copies of the same basic shape (figure 9). The increment h is the smallest required in our DRAW or MOVE statements. Thus the statements needed to draw a curve of order 0 (a diamond) centred at (x, y) are:

```
MOVE x-h, y
DRAW x, y+h : DRAW x+h, y
DRAW x, y-h : DRAW x-h, y
```

The distance from the centre of a curve of order n to the centre of one of its sub-curves of order n-1 will be 2^n*h.

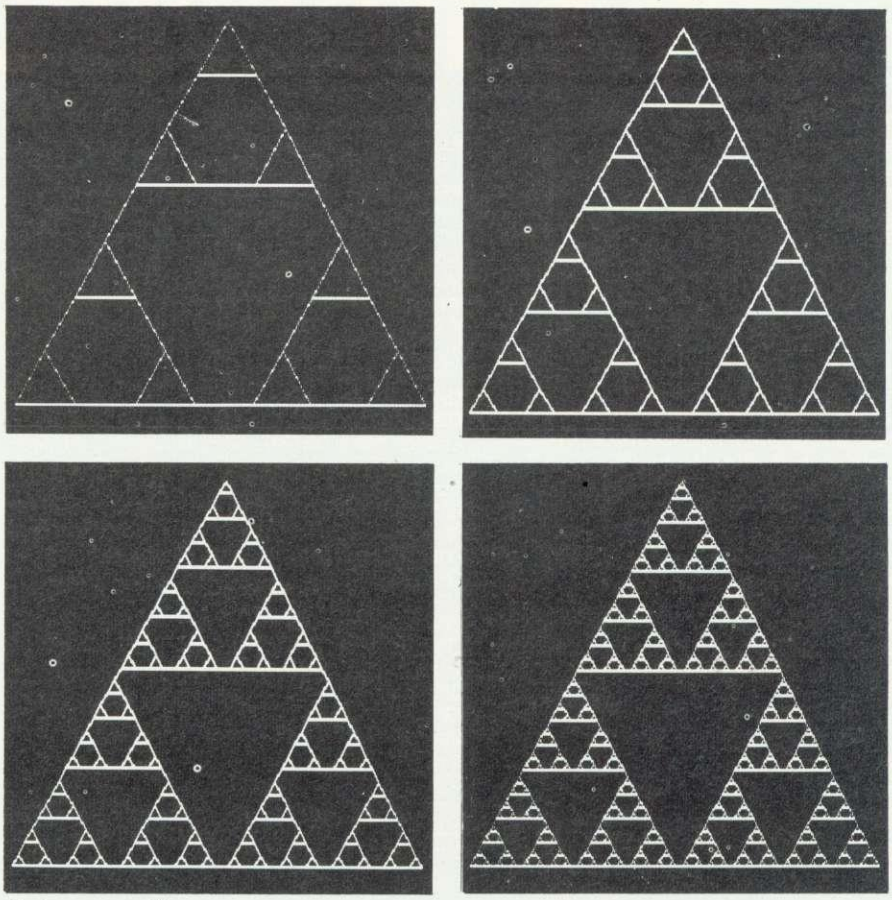
Finally, the situation at the centre of a curve of order n, when the four sub-curves of order n-1 have been drawn is illustrated in figure 10.

We need to delete the four dotted diagonal lines and draw the vertical and horizontal lines. This can be easily accomplished by drawing round the dotted polygon using alternate PLOT 9 and and PLOT 11 commands. These are relative plots, in the foreground and background colour respectively, which do not affect the last point visited on the line. The complete version is program 6.

Many non-numerical problems can be represented by a large (possibly infinite) set of problem states together with a set of moves each of which transforms one state into another. The definition of an operator may include restrictions on the states to which it can be applied.

For example, we could represent the one disc Towers of Hanoi states with a single triangle. There are three states in the one disc problem – the disc can be on one of three pegs. Each vertex of the triangle can represent a state. A line connecting two vertices represents a possible move from one state to the other (figure 11).

In the two disc problem we have three such triangles connected together, one for each possible position of the larger disc (figure 12). Similarly the three disc space diagram contains three two disc state space diagrams. The third block of photographs shows the state space diagrams for the 3, 4, 5 and 6 disc problem. Program 7 generates these diagrams by recursion.

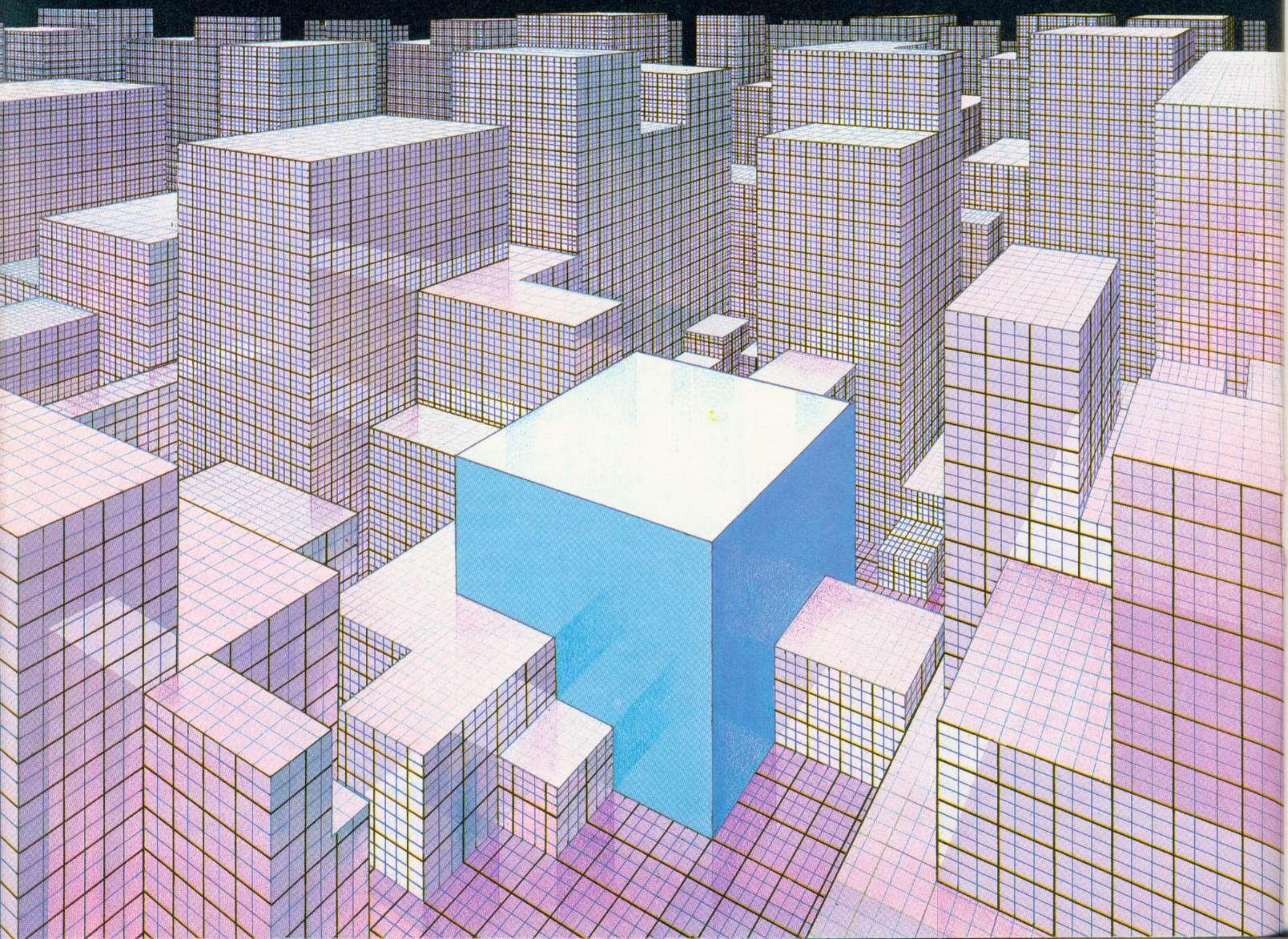


State space diagrams

```
 10   base = 800
 30   xleft=(1280-base)/2 : xright = 1280-xleft
 40   xtop=xleft+base/2
 50   root3=SQR(3)
 60   height= base*root3/2
 65   ybottom = (1024-height)/2
 66   ytop = 1024-ybottom
 70   INPUT "No. of discs",n
 80   arclength=base/(2^n-1)
 90   MODE 0
100   PROCdrawgraph(n,xleft,xright,ybottom,
      xtop,ytop)
110   k=GET:MODE 7:END

120   DEF PROCdrawgraph(n,x1,x2,y12,x3,y3)
130   LOCAL subside, subheight
140     IF n=0 THEN ENDPROC
150     subside = (2^(n-1)-1)*arclength
160     subheight = root3*subside/2
170     PROCdrawgraph(n-1,x1,x1+subside,
        y12,x1+subside/2,y12+subheight)
180     PROCdrawgraph(n-1,x2-subside,x2,
        y12,x2-subside/2,y12+subheight)
190     PROCdrawgraph(n-1,x3-subside/2,
        x3+subside/2,y3-subheight,x3,y3)
200     MOVE x1+subside,y12
210     DRAW x2-subside,y12
220     MOVE x1+subside/2,y12+subheight
230     DRAW x3-subside/2,y3-subheight
240     MOVE x2-subside/2,y12+subheight
250     DRAW x3+subside/2,y3-subheight
260   ENDPROC
```

Program 7. Draws a map of Towers of Hanoi problem



BEEB, BRAILLE & THE BLIND

Dr Thomas Vincent has used BBC micros at the Open University to help teach students who are blind or visually handicapped

With the introduction of a new micro, there normally follows a range of input/output devices. These may include joysticks, alternative keyboards, speech input and output. Generally, these are aimed at the leisure market, but their adaptation for the disabled has been an interesting development.

In the past, the disabled have been assisted with equipment that is very specialised and, consequently, costly. With micro hardware, adaptations can be achieved through software – important in relation to cost.

The BBC model B has been used with alternative input devices and synthetic speech output to provide a configuration that can be used in schools for the blind and partially sighted. With the exception of the interface for the Perkins brailler, the applications described in this article have been achieved through software developed for commercially available hardware.

Early in 1982, the MEP and DoI funded a project at the Open University to investigate the use of the BBC micro for the visually handicapped in schools. This followed two successful years of using micro and speech synthesisers in the homes of blind OU undergraduates. The objective of the new project was to develop a range of software that would provide programming in Basic and computer-assisted learning.

The hardware in current use is shown in figure 1. Interfaced to the BBC micro is a Star Microterminals concept keyboard, a Votrax-Type'N'Talk speech synthesiser, and a Perkins brailler. The last is the standard device used by the blind to produce hardcopy braille (combinations of dots produced by pressing the six main keys). It has been adapted by adding micro-switches under each key which transmit signals via an interface to the user port.

The interfacing of the Perkins brailler is important as it gives an opportunity to assist in braille teaching. A young person may have difficulty in 'reading' what they have typed because their tactile sensitivity to the raised braille dots may be at an early stage of



BBC micro flanked by Perkins Brailler, with Votrax on top of the monitor

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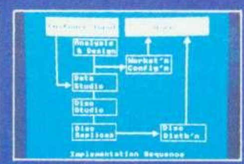


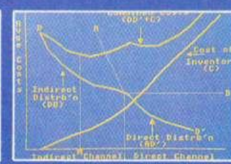
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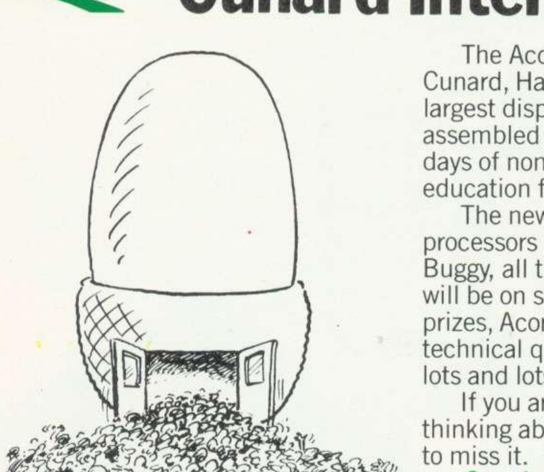
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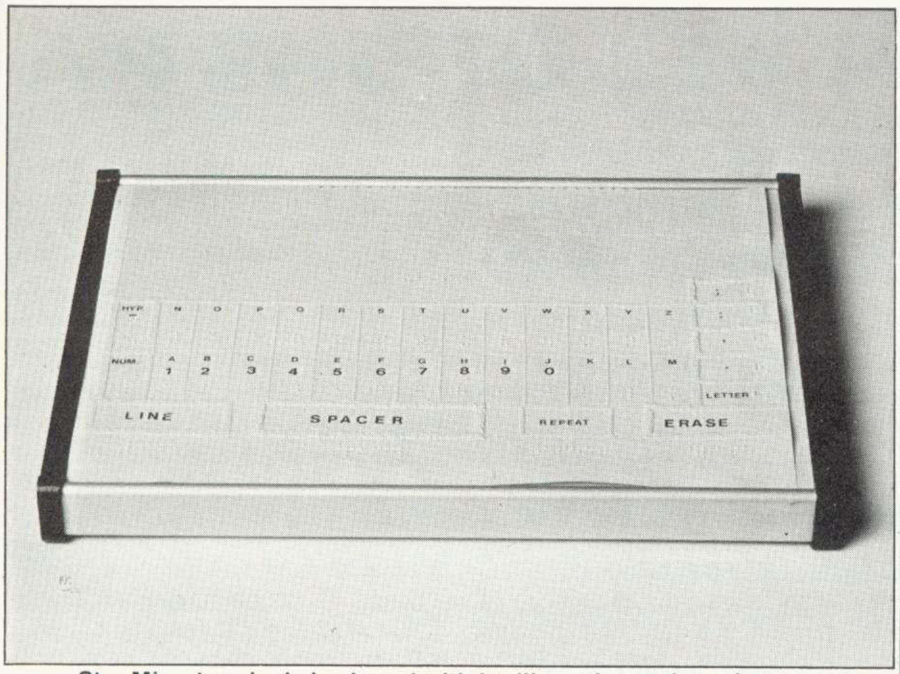
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Star Microterminals keyboard with braille-embossed overlay

development. Hence, providing a spoken output offers some help.

One of the teaching programs allows a pupil to type in any word which is spoken and can be repeated or corrected. Once the program is loaded by the pupil only needs to use the Perkins brailler. The teacher can access a complete record of the pupil's work from the micro keyboard at any time. For the partially sighted, the words are displayed during typing with double-height characters (mode 7).

Enhancement of tactile sense is achieved with a concept keyboard, which has 128 individual sensitive areas. Overlays are used which have braille-embossed characters (a character occupies one individual area, and is selected by pressing one adjacent area). In this way all of the 63 braille characters can be represented and selected. Programs developed for the Perkins brailler have a procedure which makes the output from the concept keyboard compatible with its output. Hence, the same program can be used with either input device. The program recognises which device is being used by the range of ASCII values: concept keyboard, 128–255; Perkins brailler, 1–127.

The Votrax-Type'N'Talk provides an unlimited vocabulary for various applications. In some cases look-up tables are incorporated. These change the text before it is sent to the speech synthesiser to achieve improved pronunciation. For example the word 'error' is pronounced better if it is changed to 'airor'. This technique is adopted with a Basic interpreter modification that gives programming facilities with synthetic speech as the output medium. A screen can be used, but the interpreter is designed for a blind person, hence it is assumed that programming can be achieved without visual output. Full editing with the 'copy' and 'cursor' keys is available.

An important feature is that Basic programs written with the standard interpreter will run under the modified interpreter. This helps a teacher writing a program for a visually handicapped person where program development or debugging is more conveniently carried out with a screen display rather than speech. The only restrictions with the modified interpreter are the use of mode 7, and HIMEM must not be changed. All other facilities are available although graphical representations do not have an immediate speech equivalent.

It is hoped that the text-to-allophone speech chip from Acorn will provide higher quality speech at a lower cost and can be incorporated into the configuration already developed. Existing software has been designed with this change in mind.

At least for one section of the disabled community, the exploitation of commercially available hardware through software development has become possible.

AN END TO KEY POUNDING

Paul Beverley explains how to wire up a 16-digit keyboard for numeric entry — or anything else you care to program

THIS month we look at a simple piece of hardware which, with software, produces a useful extra for the BBC micro – a 16-key keyboard which is entirely programmable. Also it has an auto-repeat exactly like the main board and responds to the *FX commands used to set delay and repeat times. The ease with which we can produce this demonstrates once again how versatile the Beeb really is.

Because the new keyboard is entirely programmable, it can be used for entirely different applications. The most obvious would be for numeric-entry (provided as standard on micros such as the Commodore Pet). Apart from the 10 number keys, the other six could be used for a decimal point, return key, and four cursor keys (figure 1). This configuration is produced by the keyboard program as it stands.

An alternative would be for hexadecimal entry. There seems to be no standard layout, but as the keyboard is programmnable, it can be arranged as desired. The procedure 'hex_entry_keys' gives the layout shown in figure 1b.

To produce words or commands the keyboard can double up on the function keys. If you get it to produce codes &80 to &8F, they have the same effect as *KEY0 to *KEY9, *KEY10 (without causing a break), COPY and the four cursor keys (figure 1c).

With computer games the second keyboard could be programmed for the characters needed and used to save wear on the main keyboard. Also you could provide electrical connections on the keyboard instead of the actual key to control a joystick consisting of switches rather than potentiometers. These switched joysticks are available from most electronic component dealers. If writing games programs you can make them to respond to codes generated by the second keyboard, say codes 150 to 165 or whatever, rather than from the main keyboard.

As you can see from figure 2, which shows the circuit diagram of the second keyboard, the hardware needed is minimal. The keys are set out in a four by four square. The four lines which form the rows are three output lines from the User Port, PB4 to PB6, and the zero volts line. The lines which form the columns are four lines of the User Port as input – PB0 to PB3. To detect when one of the keys has been pressed and generate an interrupt, the four column lines have been gated ready to apply to the CB2 control line. However, before the key-pressed signal goes to CB2 it is gated in with PB7.

The idea of this is that PB7 can be used to control whether an interrupt is actually sent to the processor when a key is pressed. This could be used to disable the second keyboard, but this is not really necessary since it works using interrupts and does not affect the computer itself unless a key is being pressed. The real reason for using PB7 as a control line is to combat key bounce.

When a key is pressed, there will be a certain amount of making and breaking of the contact for a number of milliseconds. Thus after the first interrupt has been generated, PB7 is used to inhibit

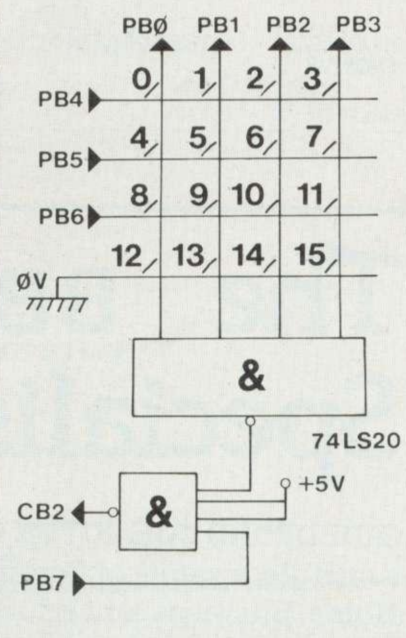


Figure 2. Hardware for the second keyboard

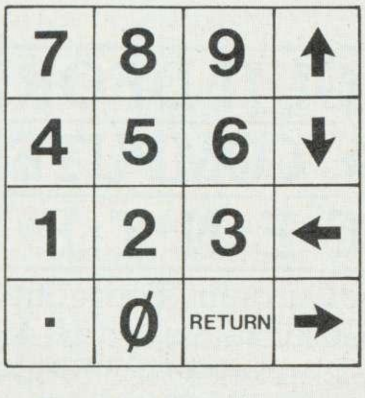


Figure 1a. Numeric entry

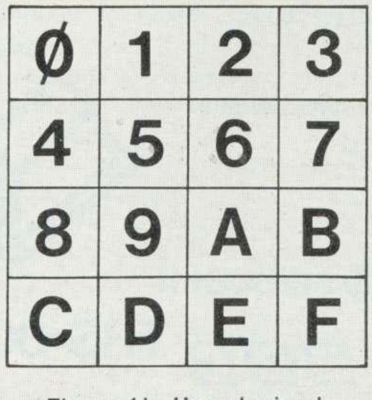


Figure 1b. Hexadecimal

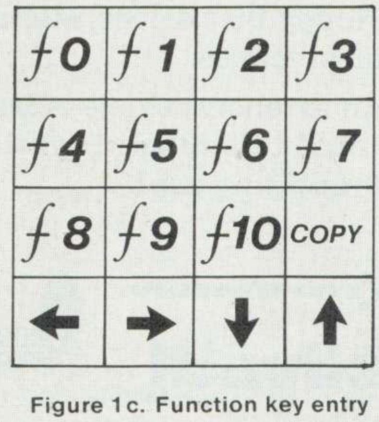


Figure 1c. Function key entry

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further interrupts until the key has settled down. This is done automatically by using a timer on the 6522 VIA which uses PB7 as an output. While timer 1 is on, PB7 is low which automatically inhibits the interrupts.

But how long do you wait? Various keys I tested produced bounce times between 800 microseconds (us) and about four milliseconds (ms). Program 1 provides a means of testing your keyboard. If you run this program with the keyboard attached, it will give a measure of key bounce. You can then simply set the delay generated by the VIA so it is just longer than the longest bounce.

If you run program 1, and then press the bottom left hand key, you should get a fairly random looking square-wave on the screen. The time across the screen represents 7 x 256 us. If the plot has not settled down to a steady low level by the time it reaches the other side, you will have to add extra NOP instructions by changing the value of W in line 10. Each NOP adds 256 us to the time scale across the screen. When you know the time taken by the key to settle down, you can set the value of the variable 'bounce_delay' in program 2. This is actually the number of lots of 256 microseconds of the delay, so if the key settles down well within the length of the display on the screen when W = 0, then bounce_delay could be set to 5 as in the listing.

```
 10 W = 0:REM The number of NOP's for delay
 20 REM Each NOP adds 256 microseconds total
 30 DIM CODE% 100, S% 255
 40 P% = CODE%
 50 PROCassemble
 60 G% = 1
 70 B% = &FE60
 80 MODE 0 : REM or MODE 4
 90 VDU19;4;0;
100 PRINT"Press SPACE BAR when ready";
110 FOR J% = 900 TO 0 STEP -100
120    MOVE 0,J%
130    REPEAT UNTIL GET = 32
140    CALL CODE%
150    FOR N% = 0 TO 255
160       A% = S%?N%
170       A% = A% AND 1
180       DRAW N%*4,J%+A%*64
190       NEXT
200    NEXT
210 END
220
230 DEFPROCassemble
240 [OPT 0
250 LDA#1
260 LDX#0
270 .is_it_pressed
280 BIT &FE60
290 BNEis_it_pressed
300 .read
310 LDA &FE60
320 STA S%,X
330 ]:IF W=0 GOTO340
340 FOR T=1TOW:[OPT 0:NOP:]:NEXT
350 [OPT 0:INX
360 BNEread
370 RTS
380 ]
390 ENDPROC
```

Program 1. Measures keyboard bounce

One problem that arises in writing software for the second keyboard is which operating system to write for, and whether to make it Tube-combatible. I decided that to try to write it for the 0.1 operating system was futile since the 1.2 version should be well established.

The problem of Tube-compatibility is more difficult, as the software has to be interrupt-driven and therefore in machine code. Initially I tried to stick to the rules and never use LDA or STA to a specific memory location; only LDA and STA immediate, and OSBYTE calls. Flags and counters are needed for the various functions, and so for these, a DIM statement was used to make them Tube-compatible. However, since I did not have a second processor (who has?) I could not check this program.

The resulting program had the disadvantage of being longer, more complex and slower than necessary. In addition, since it used a DIM statement to select space for the program, you would have to merge the assembly language program with each applications program that used it.

Although the Tube version worked, I decided to do a stripped down version avoiding the rigmarole of OSBYTE calls for accessing the 6522 VIA, while still maintaining OSBYTE calls for things such as reading repeat and delay times (as set by *FX11 and *FX12) and putting characters into the keyboard buffer (program 2). The point is that no matter which operating system is used, the addresses of the 6522 VIA cannot change as they are determined by the hardware, but for the other routines it is necessary to use OSBYTE calls so when new versions of the operating system come along, you will not have to change this program.

One major problem is where to store the machine code as it is longer than 256 bytes and will not fit into &D00 to &DFF. The placing of these routines is critical because they are interrupt service routines – if they get over-written the whole machine flops. Every few milliseconds interrupts are being generated and all are directed first of all to these routines before being re-directed

```
10 IF PAGE < &1B00 PRINT " PAGE = &1B00":END
20 PROCsetvariables
30 FOR PASS = 0 TO 2 STEP 2
40   PROCassemble
50   NEXT PASS
60 CALL initialise
70 PROCnumeric_keys
80 REM PROChex_entry_keys
90 REM PROCfunction_keys
100 PRINT" *SAVE NUMKEYS ";~CODE;" ";~P%+16;" ";~CODE
110 END
120
130 DEFPROCnumeric_keys
140 $table = "789x456x123x.0"
150 table?3 = &8F
160 table?7 = &8E
170 table?11 = &8C
180 table?15 = &8D
190 ENDPROC
200
210 DEFPROChex_entry_keys
220 $table = "0123456789ABCDEF"
230 ENDPROC
240
250 DEFPROCfunction_keys
260 FOR N = 0 TO 15
270   table?N = &80 + N
280   NEXT
290 ENDPROC
300
310 DEFPROCsetvariables
320 CODE = &1902
330 bounce_delay = 5
340 IRQ1V = &204
350 IRQ2V = &206
360 oldIRQ1V = &70
370 flags = &72
380 key_number = flags
390 delaying = flags + 1
400 repeating = flags + 2
410 delay_time = flags + 3
420 repeat_time = flags + 4
430 OSBYTE = &FFF4
440
450 PB = &FE60
460 T1L = PB+4
470 T1H = PB+5
480 ACR = PB+11
490 PCR = PB+12
500 ifr = PB+13
510 IER = PB+14
520 ENDPROC
530
540 DEFPROCassemble
550 P% = CODE
560 [OPT PASS
570
580 .initialise
590 LDA #&F0              \ Set PB4 - PB7 as o/p
600 STA PB+2
610
620 LDA #&80              \ Timer 1 output on PB7
630 STA ACR
640
650 LDA #0                \ Set PCR for CB2 neg. active
660 STA PCR
670
680 LDA #128+64+8         \ Enable interrupts, T1 & CB2
690 STA IER
700
710 .changevectors
720 SEI
730 LDA #newIRQ2V MOD 256
740 STA IRQ2V
750 LDA #newIRQ2V DIV 256
760 STA IRQ2V + 1
770
780 LDA IRQ1V
790 STA oldIRQ1V
800 LDA #newIRQ1V MOD 256
810 STA IRQ1V
820 LDA IRQ1V + 1
830 STA oldIRQ1V + 1
840 LDA #newIRQ1V DIV 256
850 STA IRQ1V + 1
860 CLI
870 RTS
880
890 .newIRQ2V
900 TXA:PHA:TYA:PHA       \ save registers
910 JSR irq2_handle
920 PLA:TAY:PLA:TAX       \ restore registers
930 LDA &FC               \ restore accumulator
940 RTI
950
960 .irq2_handle
970 LDA ifr
980 AND #64
990 BNE clear_interrupt \ If timeout THEN
1000                      \ clear_interrupt
1010 LDA #0               \ ELSE start Timer 1.
1020 STA T1L              \ Low byte first
1030
1040 LDA #bounce_delay
1050 STA T1H              \ then high byte.
1060 JSR inPB             \ Clear interrupt.
```

continued ▶

Program 2

```
1070
1080 .return
1090 RTS
1100
1110 .clear_interrupt
1120 LDA T1L
1130
1140 LDA #128
1150 STA delaying
1160 JSR read_delay
1170 JSR readkey
1180 RTS
1190
1200 .newIRQ1V
1210 TXA:PHA:TYA:PHA      \ save registers
1220 JSR irq1_handle
1230 PLA:TAY:PLA:TAX      \ restore registers
1240 JMP (oldIRQ1V)
1250
1260 .irq1_handle
1270 LDA &FE4D
1280 AND #64
1290 BEQ return
1300
1310 LDA repeating
1320 BEQ waiting
1330
1340 DEC repeat_time
1350 BNE return
1360
1370 JMP read_a_key
1380
1390 .waiting
1400 LDA delaying
1410 BEQ return
1420 DEC delay_time
1430 BNE return
1440 LDA #0
1450 STA delaying
1460 LDA #128
1470 STA repeating
1480
1490 .read_a_key
1500 JSR read_repeat
1510
1520 .readkey
1530 JSR inPB
1540 BNE which_row
1550 LDA #0                \ no key pressed after all!
1560 STA repeating
1570 STA delaying
1580 JMP rts
1590
1600 .which_row
1610 LDA #12
1620 STA key_number
1630 LDY #64+32+16         \ Is it bottom row?
1640 STY PB
1650 JSR inPB
1660 BNE read_column
1670
1680 LDA #8
1690 STA key_number
1700 LDY #32+16            \ or next to bottom row?
1710 STY PB
1720 JSR inPB
1730 BNE read_column
1740
1750 LDA #4
1760 STA key_number
1770 LDY #64+16            \ or next to top row?
1780 STY PB
1790 JSR inPB
1800 BNE read_column
1810
1820 LDA #0
1830 STA key_number
1840 LDY #64+32            \ or top row?
1850 STY PB
1860 JSR inPB
1870 BEQ rts               \ If no row then give up!
1880
1890 .read_column          \ enter here with
1900 LDY key_number        \ 1 of 4 low bits of acc = 1
1910 DEY
1920 .next_column
1930 INY
1940 LSR A
1950 BNE next_column
1960
1970 STY key_number        \ Keynumber now in Y
1980 LDA table,Y
1990 TAY
2000 LDA #&8A              \ character into keyboard buffer
2010 LDX #0
2020 JSR OSBYTE
2030
2040 .rts                  \ reset lines to zero
2050 LDA #0                \ ready for next keypress
2060 STA PB
2070 RTS
2080
```

Program 2,
continued on page 65 ▶

```
2090 .read_repeat
2100 LDA #197
2110 LDX #0
2120 LDY #&FF
2130 JSR OSBYTE
2140 STX repeat_time
2150 RTS
2160
2170 .read_delay
2180 LDA #196
2190 LDX #0
2200 LDY #&FF
2210 JSR OSBYTE
2220 STX delay_time
2230 RTS
2240
2250 .inPB
2260 LDA PB
2270 AND #15
2280 EOR #15
2290 RTS
2300
2310 .table
2320 ]
2330 ENDPROC
```

Program 2. Sets up second keyboard

back to the interrupt routines in the operating system ROM. Therefore if these routines were corrupted, the next interrupt would fail to be serviced and the machine would hang up. The only way out then would be to break.

If you are not using any user-programmed characters and are on a cassette system, locations &C00 to &DFF are free, but with disc systems there is no safe area. You could put them between say &1700 and &18FF, but they may be over-written during certain disc routines such as copying. However, as long as you break before executing these commands and re-load the machine code program, there is no problem in doing that.

The other solution is to move PAGE up to &1B00 and assemble the program at &1900. This is what I have done in program 2. Before you run this you have to ensure the value of PAGE is &1B00.

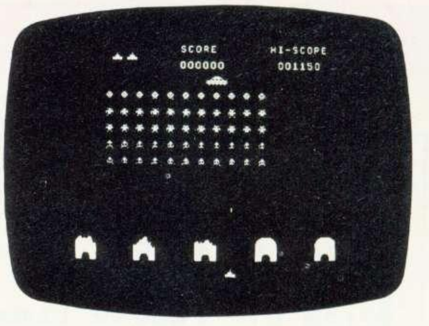
Once the program has been assembled it can be stored as machine-code and *RUN from cassette or disc. The command needed to *SAVE both routines and the table of characters is printed on the screen by line 100 so you can copy it using the cursor editing to save typing.

If you only want to build and use this keyboard, a detailed explanation of the program is not essential. However, I include it for those who would like to improve their understanding of assembly language programming, or who may want to modify the program.

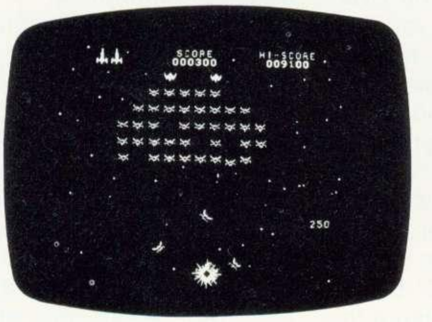
After initialisation in which the various registers of the 6522 are set up appropriately (lines 580-690), the two interrrupt vectors are altered to point to the routines in this program (710-870). While this is being done, interrupts are disabled by setting the interrupt mask (SEI), since if an interrupt occurred before the change was complete, the system would crash.

If an interrupt occurs which is generated by the external 6522 VIA from which the User Port comes, it will not be recognised by the

SOFTWARE INVASION



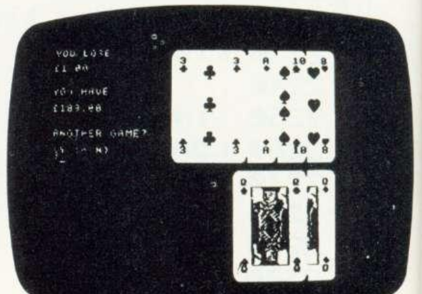
001 INVADERS
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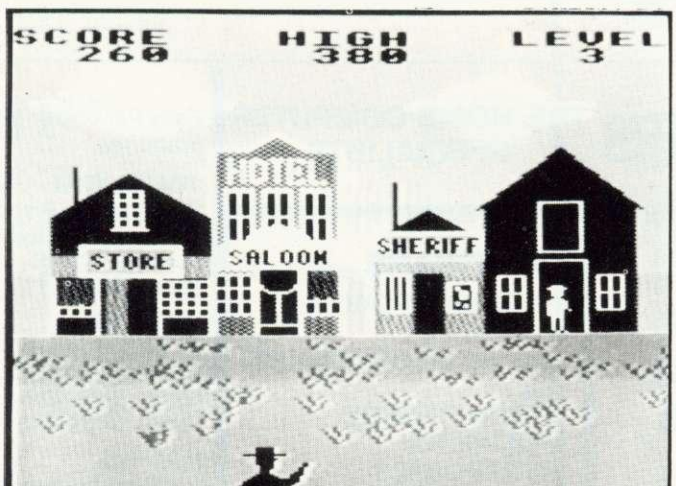
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AND NOW

GUNSMOKE

005 GUNSMOKE is the latest release from SOFTWARE INVASION. It's completely different from any game you've played before. Superb realistic sound effects - high speed animation - nail biting action - fantastic highly detailed graphics, mixing colours to produce brown, grey and olive in addition to the normal shades. You play the part of a Wild West Gunslinger, dodging bullets and trying to to shoot bandits as they appear in doors, windows, alleys and on the roof. There's sixteen different bandits who need no provocation to fill you full of lead. If you manage to kill them all, it's not over, day turns to night and the nightmare begins again.

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GUNSMOKE runs on a BBC Micro model B and costs just £7.95 inclusive.

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interrupt service routines in the operating system and will therefore be passed on to the second interrupt vector (IRQ2V). This then points to lines 890 to 1180 which first of all save the X and Y registers. Then if the interrupt is from CB2 ie a key has just been pressed, timer T1 is started which inhibits further interrupts generated by bouncing keys. If on the other hand the interrupt was generated by the timer it means the key should have settled down and it is time to find out which key has been pressed.

To produce the automatic delay and repeat facility, it is necessary to intercept the first interrupt vector (IRQ1V) so the 'time-outs' on the internal VIA which occur every 10ms can be detected. The routines check first of all (1270-1290) whether the interrupt is a VIA time-out, and if not, return to the operating system routines. If it is a time-out the routine checks to see if it is in the middle of either the delay after the first press of the key, (waiting, line 1390) or the delay for auto-repeat (1340, 1350). In each case it decrements the appropriate counter which was read by the OSBYTE routines at lines 2090-2230, and if the count has reached zero the key is read again.

To scan the keyboard you first check to see if any key is still pressed and give up if not, ie if the key has been released (1530-1580). You then look at each row in turn (1600-1870). The 'key number' is set in multiples of four according to which row the pressed key is on and then in the 'read column' routine you increment this number until you find in which column the key is (1900 – 1950). Using 'key number' as an index, the appropriate characer is picked out of the table (1980) and transferred into the keyboard buffer (1990-2020). Finally, all output row lines are set back to zero to be ready to detect the next key-press (2050, 2060).

'Do-it-yourselfers' will probably want to make up this unit on Vero-board or by making a printed circuit board (PCB). If you do not have much experience, but would like to have a go, Electro Technical Services can supply a PCB to make life very much simpler. All you have to do is solder in the chip, switches and ribbon cable connector and connect it up to the User Port via a piece of ribbon cable. The PCB has been made so it can take either expensive keys for professional applications or cheaper keys for simple home use.

For those who do not want to do any soldering at all, the same company can supply a ready-built and tested unit to professional standards. It is hoped to supply the software in EPROM so it can go into one of the sideways ROM sockets. This means the unit can be set up without loading any software from tape or disc.

Barry Pickles hosts a new cash-for-tips column. Here's a chance to show off your talents – and earn some crinkly green stuff into the bargain. There are reckoned to be some 40,000 of you out there and, bearing in mind that the Atom has been around for more than two years, you must have accumulated a fair amount of expertise.

What we're looking for are those little routines, tips and hardware mods you've discovered. Don't worry if your little wrinkle seems too simple – it's probably just what someone else has been looking for. The same rules apply here as in Ian Birnbaum's Beeb Forum. Short, sweet and as original as possible is the name of the game. I'll start you off, but this is your page, so let's hear from you!

Send your ideas to Atom Forum, Acorn User, 53 Bedford Square, London WC1B 3DZ. If you want it returned, enclose a SAE. It should be typed or printed, with programs on cassette (with listing if possible).

A SIMPLE PROGRAM TO STORE AND EDIT TEXT

THIS month's 'biggie' is for those who haven't got Wordpack. Program 1 provides a simple means of text storage and editing. If you read last month's tip about the way the Atom stores lines, this program should make sense. Text is stored as a program. Lines can be added or deleted. The first line of text must be labelled 'a', for the program to work. When reviewing, the Atom is in page mode. If line 10 has you puzzled, N acts as a logical operator (manual p32). As it stands, the only drawback is that lines may not be more than 64 characters long on the printer.

On the subject of printers, ever had the machine hang up because the printer wasn't connected? Annoying, isn't it? The following subroutine will test for an active printer and won't allow you to proceed, until connections have been made:

```
1000 IF ?#B801&#80=0 R.
1010 P.$7"PRINTER NOT
     CONNECTED!" ' "PRESS return
     WHEN READY"; IN.$A; G.1000
```

IMPROVE YOUR SECURITY TECHNIQUES

THE simplest way to prevent someone listing a program is to insert a control code at the start of a program line, which turns the screen off. Thus:

```
10REM (CTRL-U)(CR)
20 hidden section of program
...
100(CTRL-F) REM (CR)
```

This will deter casual users, but the real tyros will soon spot something is missing. You can make things harder by hiding all references to lines in the hidden section, but a cleverer way is to start the line with something innocent and turn the screen off afterwards.

A similar idea can be used to prevent program titles from appearing, if *CAT is used. However, you will need a 'bootstrap' routine to make loading appear normal – that is, a short program to load the *real* program. Commercial software houses use this technique a lot. If you really want your program to be secure, insert any innocuous control code into the filename. Only you know the proper name, only you can load it!

Please note that Barry Pickles cannot reply to queries individually.

SO OBVIOUS WITH MACHINE CODE

THIS tip is so obvious you've probably never thought of it. If you look at most commercial games software, it will consist largely of machine code – for the sake of speed. What you won't see is the assembly code, since there is usually not enough room for both code and source in memory. That's my tip. Assemble machine code into the text area, dump the source and save the assembled code along with your Basic. This has the added advantage that users will find it hard to swipe your brainwave!

```
1 REM: SON OF WORDPACK
5 DIMA5,Q64; P.$12'; Q=?18*256
10 IN."rEVIEW OR pRINT"$A; N=(?A=CH"P");
   IFN P.$2; G.30
20 IF ?A<>CH"R" P.$7$7$7;G.10
25 P.$14; ?#E6=10
30 GOS.b; GOS.b;GOS.c
40 IN."PRESS return"$A;RUN
100c DO; P.$Q'; Q=Q+LENQ+3; U.Q>=TOP;
   P.$3$15; R.
110b DO; Q=Q+1; U.?Q=CH"a"; Q=Q+1; R.
119 REM:Text starts on next line
120a TEST STRING 1
130 TEST STRING 2
```

Program 1. Save yourself £35!

SCREEN INVERSION FOR PRESENTATION

INVERTING the screen is sometimes a better way of presenting information. The Atom manual explains how to clear the screen to white, but not how to invert a filled screen. In graphics mode, the answer is to OR each location with the value −1.

The exception is mode 0, where you should OR with #3F. In text mode, although the 6847 CRT controller has an inverse capability, the appropriate pin is not connected, so a hardware change would be necessary. However, the same effect can be achieved by printing normally, then ORing screen locations with #80. If you use the 'byte indirection' operator '!' this is very fast. Turn the cursor off first, though.

In the same vein, dramatic effects can be obtained in games by toggling #B000 to alter the graphics mode. My favourite flashes the screen whenever a hit is made. It goes:

```
F.N=1TO6; ?#B000=RND;
   LI.#FB8A; N.; ?#B000=#F0
```

This works in mode 4; other modes will need the final value of #B000 to be altered (Atom manual p88).

TEXT PRINTING WITH WORDPACK

PRINTING text in graphics modes is complicated and a general purpose program to do so takes up too much memory. However, with Acorn's Wordpack ROM it is possible to mix text and graphics using a single line:

```
P.$21;[; LDY@3; LDX@96;
   JSR#ACDE; RTS; ]; P.$6
```

This can be assembled into any convenient space, where you have eight bytes free and is used by LINK P; CLEAR M, where P is the address of the assembled code and M is the graphics mode. It will not work in mode 0 (but it's not needed there, anyway) and, in modes other than mode 4, the character set will be progressively larger, as you use a lower mode. Colour modes give strange results, because of the way cells are mapped in colour.

DECIMAL PLACINGS

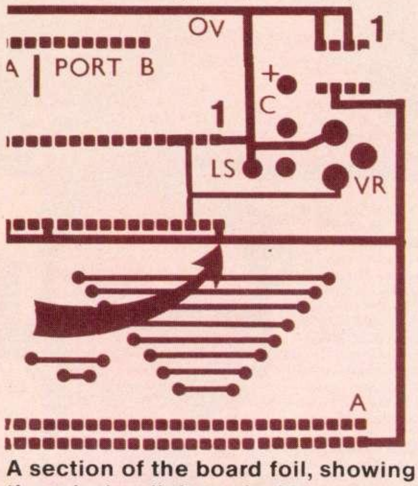
WHEN using the Atom in financial work, it is often necessary to calculate to four decimal places, but the final answer needs rounding to two decimal places. To do this, add 0.005 before printing out the result. This will perform 5/4 rounding.

ERRORS IN ATOM ARTICLES

AN ERROR has been spotted in the article 'Sound out of an Atom' in May's *Acorn User*. The PCB foil pattern is incorrect, as pin 40 of the AY38910 should be connected to the 5v supply – but it isn't.

The circuit diagram (figure 1) on page 57 shows it connected correctly. The diagram below shows the section of the pattern as it should be. Our apologies to readers, and thanks to Brian Moulton for pointing this out. Please spread the word.

Now turn to page 57 of June's issue. The graphics fix routine given in the Atom Forum has two errors, Line 10 should begin P.$21 . . . not S21, and line 9000a should begin !#222=!#3FE. . . We hope this didn't leave too many people stumped.



A section of the board foil, showing the missing link to pin 40

SOLUTION TO THOSE BOUNCING KEYBOARDS

LAST month we looked at some inbuilt delay routines in the Atom. The one at #FB83 is user programmable and can be used to 'debounce' the keyboard. Keybounce (double striking) was a common fault on the Atom until Acorn replaced the cheap keyboard used on early models. The following routine alters the ReaDCHaracter VECtor (at #20A,20B in block zero) to point to a new routine at #21C, inserting a delay after reading each character. The delay is determined by the value of the X register in line 15. Here it is 4/60ths second, but it can be altered to any convenient value. It is activated by LINK#21C and deactivated by break:

```
 5 P=#21C; [
10 LDA@26; STA#20A; LDA@2;
   STA#20B
15 JSR#FE94; LDX@4; JSR#FB83;
   RTS: ]
20 LI.#21C; E.
```

STRIP OFF THE PAINFUL ZEROES WITH FP ROM

IF YOU use the floating point ROM, you have doubtless found the Atom's insistence on always printing numbers with 10 characters a real pain! The next routine will come as a godsend, since it removes trailing zeroes, by converting the number to a string ($P) and stripping it. It is written as subroutine z:

```
1000z P=#8200; STR %N,P;
   ?(P+20)=13; IF ?(P+10)
   <>CH"E"G.1020
1010 F.Z=(P+10)TO(P+14);
   Z?10=?Z;N.
1020 Z=P+10; DO; ?Z=13;
   Z=Z-1; U. ?Z<>CH"0"; IF
   ?Z=CH"="; ?Z=13
1030 P.$P,$(P+20)';R.
```

To test it, try this line:

```
20 DO FIN."F.P. NUMBER"%N;
   GOS.z; U.0
```

SOUNDS INTERESTING

Gabriel Gilson outlines some simple sound effects on the Atom with crashing examples

THE Atom is regarded by many as dated, but although it cannot produce four-part harmony, some interesting and useful sounds can be produced.

A simple bleep generator is given by program 1. To operate this set ?#80 to any number between 1 to 255 inclusive, depending on what frequency of note is required, and set ?#81 again to any number between 1 and 255, depending on the length of note. If LINK VV0 is executed, the computer will issue a bleep using your information. The program works by exclusive OR-ing the speaker location (?#B002) with the number 4 in binary (00000100). This produces a single click; depending on the time between each click (value of ?#80) a different note is produced. ?#81 varies the number of clicks produced.

Different effects can be created by changing parts of the program. If lines 95 and 120 are replaced by:

95 DEY;INC#80 (or 95 DEY;DEC#80)
120 ?#80=10;?#81=255

and this line is added,

130 LINK VV0;GO TO 130

two different 'alien mothership' sounds can be produced. This is done by increasing or decreasing the value of ?#80 within the machine code program.

Tunes can be created by using table 1. Values of #80 produce the nearest approximation to the notes indicated.

Table 1. Note values

G - 254	G' - 120	A - 57
G' - 239	A - 113	A' - 53
A - 226	A' - 107	B - 50
A' - 213	B - 101	C - 48
B - 201	C - 95	C' - 45
C - 190	C' - 90	D - 42
C' - 179	D - 85	D' - 40
D - 169	D' - 80	E - 38
D' - 160	E - 75	F - 36
E - 151	F - 71	F' - 34
F - 142	F' - 67	G - 32
F' - 134	G - 62	
G - 127	G' - 60	

Lowest note - 254
Highest note - 32

For example, program 2 produces the old favourite 'Good King Wenceslas'. To change this program, first list all the note codes from the table, and list the note lengths, using 1 for ½ beat, 2 for 1 beat, and so on. These lists must then be turned into strings. Lines 40 to 60 give $A, the note codes, and line 30 gives $B, the note lengths. Subroutine b (lines 140-170) plays the tune. Line 140 extracts the first three members of $A (in this case 1, 2, and 7), turns them into the proper numbers from their character values (-48) and makes them into a single number (127). ?#80 is then set to this value.

Now comes the difficult bit. In line 160, ?#81 is set to the length of the note. It extracts the necessary member of $B, makes it into its proper number from its character value (-48), multiplies it by 5100 and divides it by the value of ?#80. This is done because on the Atom, the higher a note is, the shorter it is. Line 160 ensures the notes are the correct lengths. The constant 5100 is chosen for a particular tune so that ?#81 never takes a value greater than 255. Clearly the safe default value for this constant is 255 x 32 (highest note on table)/4 (assuming this to be the longest note in string B), which equals 2040. But it is best to set the constant to 255 multiplied by the highest note in your tune (lowest number) divided by the longest note length in your tune. This note is then played by a LINK VV0, and the next numbers are extracted.

The DIM statements in line 10 must be changed to the number of elements in each string. Then the FOR . . . NEXT statements in lines 70-80 must be altered to suit your tune, and to allow for repeats etc.

Sounds can also be produced in a normal Basic program, either by a P.$7 which produces a bleep like CTRL-G does, or by implementing what the machine code program does in Basic, as in program 3.

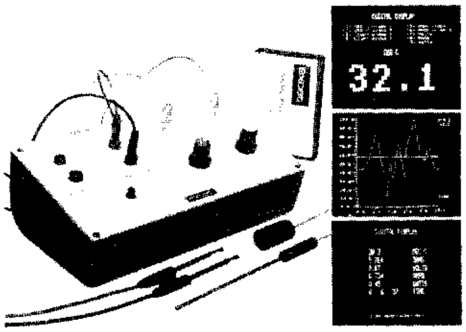
The statement ?#B002=?#B002:4 actually produces the single click. The tone on this can be altered by

```
5 REM BLEEP
10 DIMVV(4),P(-1)
20 L=#B002
25 P.$21
30 [
40 :VV0 LDA L
50 LDY #81
60 :VV1 LDX#80
70 :VV2 DEX;BNE VV2
80 EOR @4
90 STA L
95 DEY
100 BNE VV1
105 RTS
110 ];P.$6
120 END
```

Program 1. Simple bleep generator (½k)

Program 2. Good King Wenceslas (1½k)

```
5 REM GOOD KING WENCESLAS
10 DIMA119,B40;C=0;P.$12;M=0
20 GOS.a
30 $B="222224222244222224222244222224222444"
40 $A="127127127113127127169151169151134127127085095101113"
50 $A+LEN(A)="101113127151169151134127127169169151134127127"
60 $A+LEN(A)="113085095101113127095127"
70 F.I=1TO2;F.O=0TO12;GOS.b;N.O;C=0;M=0;N.I
80 C=39;M=13;F.O=13TO39;GOS.b;N.O
90 E.
100 aDIMVV(4),P-1;L=#B002;P.$21
110 [;:VV0LDAL;LDY#81;:VV1LDX#80;:VV2DEX;BNEVV2;EOR@4;STAL;DEY
120 BNEVV1;RTS;];P.$6
130 R.
140 bQ=(A?C-48)*100+(A?(C+1)-48)*10+A?(C+2)-48;C=C+3
150 ?#80=Q
160 ?#81=5100*(B?M-48)/?#80;M=M+1
170 LINKVV0;F.Y=1TO200;N.Y;R.
```



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changing the variable T, which increases or decreases the time between clicks. Because Basic is slower than machine code, the highest note obtainable is far lower than before.

The noises from this can be used for tunes although not so easily. Single clicks are useful in all parts of games, to make things more noticeable or just to liven things up. A useful 'rocket motor' noise can be obtained by changing line 30 of program 3 to 30?A=?A:RND.

If you are fed up with the sounds from the Atom internal speaker, sounds can be amplified by attaching one end of a five-pin DIN lead to the cassette port on the Atom, and the other end to an amplifier. Sounds from the computer should now be amplified.

Now almost 'heavy metal' music can be created – try program 4, which sounds excellent when amplified, but not so good through the internal speaker.

Finally, program 5 produces a game using all the sounds mentioned. It is a rather simple version of *Air Attack*. You are on a plane which is attempting to land on a runway (the row of 'equals' signs). But before you can do this all the buildings or X's on top of the runway must be bombed away. If the plane hits one of the buildings, you have crashed, and the game is over. If you manage to get to the far end of the runway without crashing, you have successfully landed. To drop a bomb, press the shift key, and only one bomb can be on the screen at any time. Your score (top left of screen) is incremented every time an X is hit.

The rocket motor sound is used for the plane and the bomb falls using bleeps from the machine code program. If an X is hit, a tone is produced using the Basic method. If you manage to crash, the Royal Air Force instantly rejects you, and a raspberry sound is produced, again the Basic method. If, by some fluke, you actually manage to land, the computer's reward is to play a short tune using Basic and machine code.

So although Toccata and Fugue in E sharp major is still a long way off, many varieties of sounds can be produced to enhance any program.

```
 5 REM'BASIC' CLICK ROUTINE
 1Ø T=5
 2Ø F.B=1TO2ØØ
 3Ø ?#BØØ2=?#BØØ2:4
 4Ø F.C=1TO T;N.C
 5Ø N.B
 6Ø END
```

program 3. Basic clicks (½k)

```
  5 REM HEAVY METAL
 1Ø A=#BØØ2;P.$12
 2Ø F.B=1TO3;F=2Ø;F.E=1TO2;F.C=1TO2Ø;
    ?A=?A:4;F.D=1TO F;N.D;N.C
 3Ø F=1Ø;N.E;N.B
 4Ø F.B=1TO3;F=1Ø;F.E=1TO2;F.C=1TO3Ø;
    ?A=?A:4;F.D=1TO F;N.D;N.C
 5Ø F=5;N.E;N.B
 6Ø F.C=:TO2Ø;?A=?A:4;F.B=1TO2Ø;
    N.B;N.C;F.C=1TO3Ø;?A=?A:4
 7Ø F.B=1TO1Ø;N.B;N.C;F.C=1TO15;
    ?A=?A:4;F.B=1TO5Ø;N.B;N.C
 8Ø C=5Ø;F.B=1TO5Ø;?A=?A:4;
    F.D=1TO C;N.D;C=C-1;N.B
 9Ø F.B=1TO25;?A=?A:4;F.C=1TO5;N.C;N.B
1ØØ F.B=1TO3Ø;?A=?A:4;F.C=1TO15;
    N.C;N.B;F.B=1TO4Ø;?A=?A:4
11Ø F.C=1TO3Ø;N.C;N.B
12Ø END
```

Program 4. Heavy metal (1½k)

```
  5 REM AIR ATTACK
 1Ø DIMVV4,P-1;L=#BØØ2;P.$21;[;
    :VVØLDAL;LDY#81;:VV1LDX#8Ø
 2Ø :VV2DEX;BNEVV2;EOR@4;STAL;
    DEY;BNEVV1;RTS;];P.$6
 3Ø P.$12;F.A=1TO1Ø;P.';N.;?#E1=Ø;
    B=32768;S=Ø;G=#BØØ2;@=Ø
 4Ø P."X     X  X    XX          X  X  XX "'
 5Ø P."X     X XX  X XX         XXX XX XXX"'
 6Ø P."XXX   X XX XX XX       XXXXXXXX XXX"'
 7Ø P."XXX XX XX XX XX X XXXXXXXXX XXX"'
 8Ø P."XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX"'
 9Ø P."================================"
1ØØ ?B=#23;?(B+1)=#3D;?(B+2)=#2E
11Ø IFE=Ø;IF?#BØØ1<>#FF D=B+32;
    E=1;?#81=1ØØ;?#8Ø=15Ø
12Ø IFE=ØG.18Ø
130 ?D=#2A;F.R=1TO 100;N.;?D=32
140 D=D+32;IF?D=#18
       S=S+1;F.P=1TO 50;?G=?G:4;
       F.0=1TO 20;N.;N.
150 IFD>33247 E=0
160 P.$30 S
170 LINK VV0;?#80=?#80-1
175 REM Decrease high value of C
       to speed up game
180 F.C=1TO 75;?G=?G:R.;N.
190 ?B=32
200 B=B+1
210 IF?(B+2)=#18 G.240
220 IF (B+2)=33248 G.250
230 G.100
240 @=0;P.$12"YOU HAVE CRASHED"
      ''"SCORE:"S;G.280
25Ø P.$12"YOU HAVE LANDED.CONGRATULATIONS";
    ?#81=255;?#8Ø=12Ø
26Ø LINKVVØ;?#8Ø=1ØØ;LINKVVØ
27Ø ?#8Ø=1ØØ;LINKVVØ;F.D=1TO9Ø;
    ?G=?G:4;N.;E.
28Ø F.L=1TO1ØØ;?G=?G:4;
    F.K=1TO3Ø;N.K;N.L;E.
```

Program 5. Simple Air Attack (2k)

The faithful Seikosha comes under George Hill's critical eye

CHEAP HOBBY PRINTER – BUT NOISY

THE Seikosha AP100A (orGP100A) has been on the market for some time. The reason for this review is that it has many of the features described in previous articles, it is cheap (about £215) and deserves serious consideration as a first printer.

First its good points. The Seikosha is neat and attractively packaged. It has a tractor feed mechanism which handles the paper (up to 21.5 cm wide excluding the tear off margins) conveniently and accurately.

It is a conventional dot-matrix printer with seven dot wires, printing its characters on a seven by five matrix. It has a Centronics interface, which can plug into most parallel printer ports with a suitable lead.

Carbon copies can be produced with suitable paper, and the impact strength between wires and paper can be adjusted to vary the darkness of the print, or to cope with differing paper thicknesses.

The printing style is good, especially for capital letters and numerals, though the limitations of the matrix are evident in the small (lower case) letters. Look closely at the letters g and y for instance in the example printout (figure 1). The typeface is fine for listings and would suit most home-users for word processing, but the business-user would probably require something better.

There is a useful, though non-standard tab facility, and double-width characters can be printed, though not double-height or condensed.

The seven dot wires can be fired individually, giving the ability to produce pictures. Graphics patterns can be repeated automatically, allowing you to underline text. There is also a code to allow you to 'tab' in graphics mode and all the various styles can be mixed on a single line (figure 1).

As with all hardware, however, you only get what you pay for – and the Seikosha has its limitations. The most obvious one is an appalling din which accompanies any printing. It seems incredible that such a small device should be capable of producing its variety of whirrs, clatters and buzzes. In my house the whispering Olivetti was restored when this test was over!

The printer is unidirectional. The print speed of 30 characters per second is adequate for short program listings, but for long files (for example this article), the printout seems interminable.

You cannot use cut sheet or roll paper, and there was no mention of any modifications or extras being available. Similarly no mention is made in the manual of an optional serial interface. I presume you need the next model in the range (the

```
>This is to illustrate the normal Print style

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG

The quick brown fox jumPs over the lazy dog again in lower case

This illustrates the TAB function.

                  Position 20                  Position 45

This is in exPanded Print and this is back to normal.

           RePeated graPhics data, and POS used to underline

Now mix it all on one line !

 NORMAL  EXPANDED            NORMAL             EXPANDED

To demonstrate PROCTAB(A)

01234567890123456789012345678901234567890123456789012345678901234567890123456789
          ^POS10              ^POS30                                 ^POS67

To demonstrate PROCUL(A$,A)

UNDERLINING IS EASY

EVEN WHEN "TABBED"
```

Figure 1. Example output from Seikosha GP100A. Notice the style of 'g' and 'y'.

250) to get this.

The Seikosha is styled as a graphics printer, but a 480-dot line is limiting. Simple dumps are satisfactory, but pattern dumps cause problems, as they need an absolute minimum of 512 dots per line for a full screen from the BBC micro, and 640 dots is more convenient. The seven-dot band requires some tricky programming in pattern dumps. The dot wires are rather coarse, and the quality of the graphics output is not as good as on more expensive printers (figure 2).

There is no form-feed so you cannot advance the printer to the top of the next page from the keyboard (unless you are willing to send multiple linefeeds). I found this one of the most irritating omissions.

The manual is rather like the curate's egg – good in parts. Its contents vary from the ridiculous: 'Power. The lamp is on when power is turned on and off when it is off'; to the cryptic and unhelpful 'The two bytes that follow the POS code are the ASCII code numbers to indicate the absolute address away from the home position (character units)'. That is almost all the help you get on the tab facility!

Sections devoted to the mechanism, loading paper and ribbon and general adjustment are clear and concise. The description of the interface is good, though most people do not need to know the details. There is the usual waste of space, five pages being used for magnified pictures of the dot patterns for the complete characer set.

It is in the section on 'input data format' that the manual writer went to pieces! The explanations are far too brief. Details of control codes for tab (called POS), double-width, and both types of graphics, with a full page of examples, take less than three small pages which include diagrams (and the snippet quoted above). There are no example Basic programs, which is odd, as I would think most buyers will be Basic users.

Two different conventions for hexadecimal numbers are used without explanation, and without translation into decimal. In one section (1,4) and in another (14) both mean hexadecimal 14 (ie decimal 20).

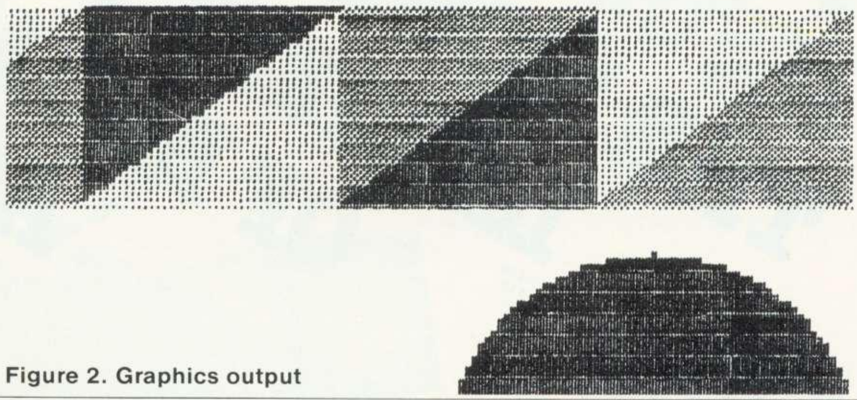


Figure 2. Graphics output

Deciphering the control codes left me with a severe headache! Letters to *Acorn User* indicate that bafflement with printer manuals is a common problem, and many people resort to buying word processors to do all the printing control. This should not be necessary, and for BBC micro owners who would like a bit of help, I have prepared a photostated sheet with a more detailed explanation of the methods of control for this printer. It can be obtained from the *Acorn User* office for 50p. With the sheet you get listings of two graphics dumps and two procedures, Proctab, which causes the printer to mimic the tab(n) facility on the BBC, and Procul which allows you to underline a string. An assembly language dump was printed in October's *Acorn User*.

In summary, undoubtedly good value for money, if you can stand the noise!

● **Our thanks to MicroAge Electronics for the loan of a Seikosha for this review.**

VERSATILE MUSIC SYNTHESISER

WITH SOME SPEAKERS TO MATCH

SOFTWARE/HARDWARE

- ☐ **Muproc, music synthesiser from Quicksilva, BBC A & B, £14.95**
- ☐ **Microvoc, Micro-Advent, £21**

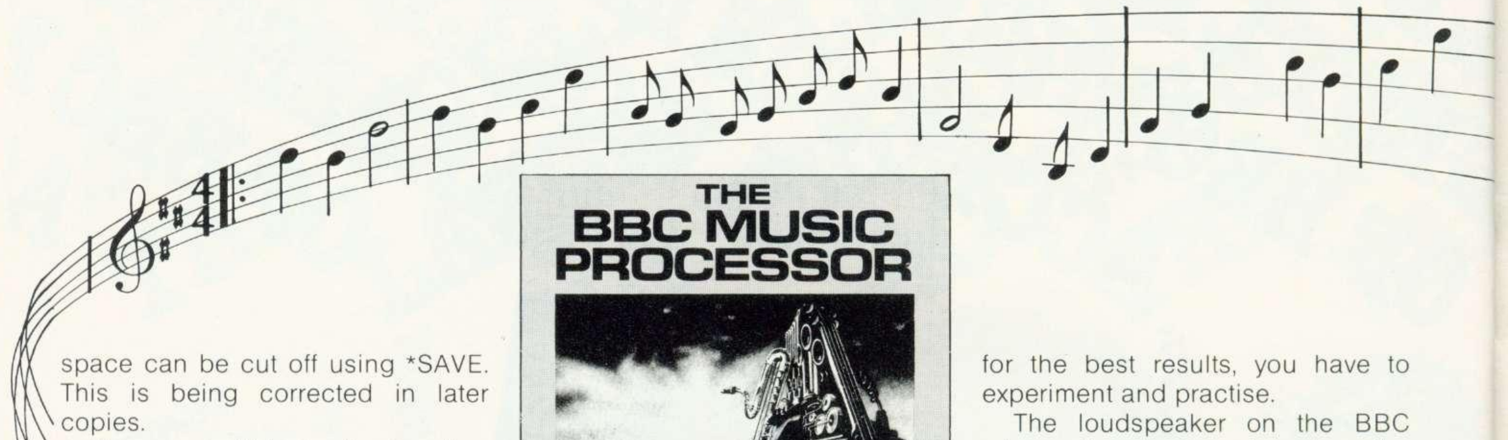
QUICKSILVA has marketed a music processor program called *Muproc* which turns your BBC micro into a synthesiser. The first thing to notice is that the keyboard is converted into a 'piano'. My daughters, who are painists, had no difficulty in playing tunes immediately, though most people would need practice. This, however, is only the start.

Muproc gives you a choice of 100,000 built-in combinations of pitch and amplitude envelopes. If these do not suit, all the parameters of envelope can be varied to create new sounds. This gives complete freedom of the BBC sound generator, enables you to play any sound the micro can produce, and build it into a piece of music. The program and its accompanying manual do not explain how the envelope parameters affect sound, so you need to experiment, or know something about envelope in advance.

The display is clearly laid out in mode 7 colour, the areas on the screen representing parts of the keyboard. It does not show musical notation, but values of the sound control of parameters currently in use. These values relate to such things as channel number, pitch and amplitude envelopes, volume, tempo, etc. There is an area devoted to the 'record' facility, and one showing the parameters for the notes being played back. Alterations to parameters are made by double depressions of the red function keys. (The addition of an explanatory label to put under the clear plastic trim is imminent says Quicksilva.)

Three pre-recorded music files are provided, although on our early review tape these were too long to load into onto disc without resetting page. However, the music only occupies half the file and wasted

page 82 ▶



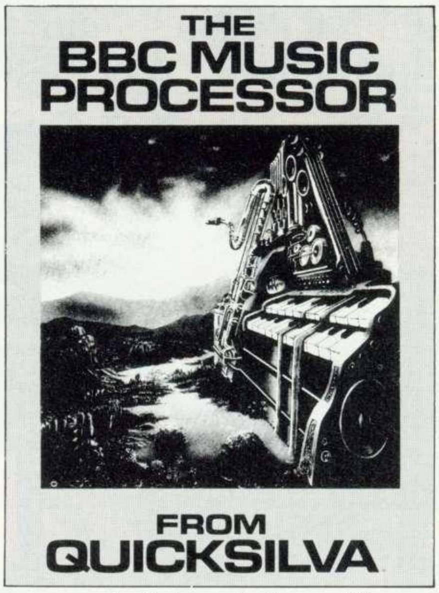
space can be cut off using *SAVE. This is being corrected in later copies.

The record/playback function impressed me most. A 'metronome' tick-tock is set to keep you in time (on channel 0). You then 'record' a tune on channel 1, using the chosen sound and volume. Notes to edit can be deleted or changed until the tune sounds exactly as you want it. This includes the ability to change the sound of individual notes in the recording, adding vibrato, or a complete change of tone colour. You now switch to channel 2, and record an accompaniment, in the same or a different sound. Edit the accompaniment, add a third voice on channel 3 and experiment with noise effects on channel 0.

The recording is not acoustic, but kept as values in memory, which can be 'rewound' and 'fast-forwarded' audibly. The speed of record and playback is variable, and you can step through the notes one-by-one. The whole recording can be committed to tape (or disc), and replayed and re-edited through *Muproc* at any time. The amount of music or other sound which can be recorded is stated as 3000 notes,

'This is a splendid package affording hours of fun'

though I never managed to approach this limit. The length of time this would occupy on replay depends on the length of each note, and the speed of record and playback. It is several minutes of fast music, though it could be hours of slow notes! To get the maximum number of notes you have to use the 'long play' function, which compacts the notes in



memory, but stops further editing or alteration.

The program is fully re-locatable, and loaded directly from tape to a disc driven BBC micro, though you necessarily lose some memory, reducing the maximum number of notes you can record. I also split the program into its Basic and machine-code sections, altered the Basic a bit (to remove such lines as 'switch off tape recorder', an irritation to disc users!), and on re-merging and *SAVEing, the program continued to run perfectly.

The booklet supplied is clear, though perhaps over-concise. It includes a memory map, essential for the alterations just mentioned, and useful summaries. I could have wished for more initial guidance, and a worked example or two. This might be difficult, but the use of the replace-note, and delete-note functions is tricky, and needed a lot of experimentation. The typesetters seem to have had some trouble getting their arrows pointing in the correct directions, but the context normally makes the misprints understandable. (We did, however, appreciate the name of one hymn included: 'Hark the herald angels sin'.)

Overall this is a splendid package, affording hours of fun, and an introduction to synthesiser-type music. It converts your BBC micro into a musical instrument. It is something which will give interesting results immediately, but for the best results, you have to experiment and practise.

The loudspeaker on the BBC micro is inadequate for the capabilities of its sound generator, and mine produces unpleasant distortion. The capabilities of *Muproc* deserved better, so I obtained a pair of the loudspeakers marketed by Micro-Advent and advertised in the May's *Acorn User*. At a budget price of £21 they improve the sound enormously, getting rid of the bulk of the distortion. The sound chip produces a square wave as its basic 'tone', so the sound always remains spiky, but the improvement is well worthwhile.

The system includes an external volume control, fitted into the Econet hole in the case, and the speakers are plugged in to a jack socket fitted in the reset hole. The volume control is the subject of a modification at present, but is essential, or games such as *Monsters* blast you out of the room! Fitting is straightforward, involving no soldering, but you have to remove the keyboard temporarily. Clear instructions are given.

Don't think you are getting a hi-fi,

'I recommend such an upgrade for serious sound experiments'

but I would recommend such an upgrade to anyone who is contemplating serious experimentation with the sound and envelope functions, and to anyone contemplating the use of a system such as *Muproc*.

- Quicksilva, 13 Palmerston Road, Southampton
- Micro-Advent, 113 Writtle Road, Chelmsford, Essex

Barry Pickles gives his view on the latest, and cheapest, Atom utility ROM

ATOM ROM COST CUTTER

THE latest, and cheapest, Atom utility ROM is the Werom, from Watford Electronics. It is a standard 2532 chip and comes in anti-static packing, with a 10-page booklet. Installation is well described, as are the new commands, many of which have example programs given. No conflicting zero-page addresses are used and the ROM generates six new error messages, all explained.

The Werom requires the presence of the floating point ROM, fine if you have one – bad news if not! We asked Watford if there was any way round this – Procyon provide a 'dummy' ROM on request for their Disatom – but they failed to reply.

There are 21 new keywords and a full list is provided in table 1. Nine are picked out as worthy of note. Most of Werom's facilities are standard, but the inclusion of a PROC-like routine makes it a bit special. It's a shame that the F Point requirement has not been dealt with, but , still at only £11.50 (inc VAT), the Werom is a bargain.

We have now looked at all the available 'toolboxes' for the Atom, and can reach some final conclusions. Both the Program Power and Willow ROMs have been surpassed by other, later, offerings and, unless their price is further reduced, cannot be considered as giving value for money.

If you require a shape table compiler, the ROSS utility is the only one for you, and it has some useful additions into the bargain.

Slightly more expensive is A & F's Utilkit, undoubtedly the best general purpose ROM around. Werom is half the price but, if you don't have the F Point ROM, you have to allow for an extra £23.00 outlay, which radically affects its value.

Procyon's Diasatom has a number of valuable, extra features not found elsewhere and should be thought of as complementary to the other ROMs. As 'best buys', therefore I recommend:

- Utilikit by A & F Software at £19.00
- Disatom, by Procyon at £22.50

and, but only if you have the FP ROM:

- Werom, by Watford Electronics

Finally, if this were the record industry, I would now be anticipating a 'greatest hits' ROM, combining the best features of all the above. Still, now that we have 'TOP 10' software charts, who knows?

ABDO: ABFOR: ABSUB: (POP): AUTO: BREAK: CHAIN: CURSOR: DATA: READ: RESTORE: DELETE: DISASSEMBLE: DUMP: EXIT: FIND: KBD: KEY: MODIFY: ON ERROR: TAPE: REM$%

AUTO x,y	Auto line numbering, with the option of cancelling the current line and issuing (a) the previous line number; (b) same line number; (c) next line number.
BREAK #XXXX	Machine code breakpoint routine, displaying all status registers and flags.
CHAIN	Auto-run for Basic programs.
DISASSEMBLE x,y	Format is the same as the Atom assembler. Adding 'W' causes single-step operation, adding 'P' appends the assembler mnemonics to the end of a Basic program, to ease addition of commonly used chunks of code, without retyping.
DUMP x,y	An ASCII and hex dump. The ROM supplied had a 'bug', in that dumping did not stop at the specified end address, but this did not pose any real problem.
KBD	Selects two-key rollover (for lightning typists) and 'debounces' the keyboard (Acorn take note).
KEY	Has two modes. As an INKEY routine, or as a 'logical operator' which, if the key to be tested is specified, returns 'true' or 'false'. KEY can also be used to detect multiple keypresses, which makes it very useful for real-time applications.
MODIFY	A very basic machine code monitor, allowing you to inspect and/or modify memory contents. It's a drudge to use and I much prefer Procyon's approach.
REM$%	No, it's not a typing error! This is a powerful and exciting routine, allowing users to define their own keywords, as many as memory permits. Also, parameters may be passed at the time of calling. It's almost as powerful as PROC in BBC Basic, the limitations being that parameters may not be local and recursion is not allowed (although other new words may be called from the routine). Routines may be left by EXIT (to return to the point of call) or END. Words may be called in direct mode but, curiously, if Break is pressed, the word is 'forgotten', until OLD is typed. This command has to be used to be really appreciated.

Table 1. Werom keywords

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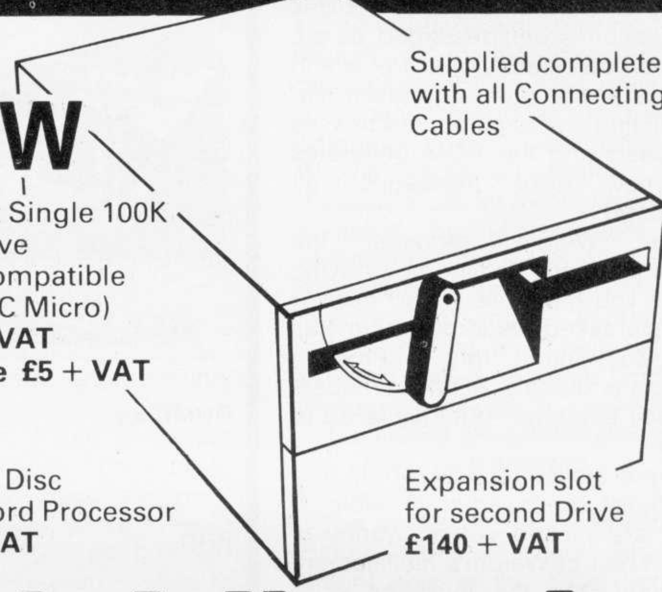
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WORTHY ADD ON DESPITE WARTS

Vincent Fojut takes a look at the £140 ATPL Autoprommer and likes what he sees



ONE of the more interesting peripherals for the BBC micro is the ATPL Autoprommer, an EPROM programmer with a novel extra. Not only can it permanently store your favourite programs onto EPROM, but an intriguing 'auto-run' feature will automatically download and run them on switch-on.

Many readers will already appreciate EPROMs. They are cheap and hold data permanently, yet can always be erased and reprogrammed. However, to take advantage of them, you really need an EPROM programmer, which brings us to ATPL's offering. How easy to use, and how versatile, is it?

The unit consists of a circuit board housed in a sturdy metal case. Protruding through the top is a 28-pin low-insertion-force (LIF) socket, into which EPROMs to be programmed are placed. In addition, there are four dual-in-line (DIL) switches, labelled 'boot selection' (more later). Two separate cables link the device to the BBC micro. The first is a 34-way ribbon cable, which connects to the 1MHz bus interface (if you use a model A, a suitable socket needs to be fitted). The second cable connects to the BBC's power-out socket. If your micro is an early model with a linear power supply, no such socket will exist, and an alternative source of zero and five volts will need to be found – for example, from the user-port. A cassette is also provided, containing both 'auto-run' and programming software (in source and object form). A slim manual completes the package.

After connecting the device to the Beeb, the first program on the cassette, the 'Prommer object code, is loaded with *RUN (recorded at 1200 baud, without 300 baud back-ups). If all is well, the program displays a 'Device?' prompt and the unit is ready for use as a normal EPROM programmer. Let's assume you have a handy utility program – a disassembler for example – that you would like to have in memory every time you switch on. At this point you would load the program, be it in Basic or machine code, into a specific location in memory (the manual suggests a start address of &1800).

Once the chosen program has loaded, the 'Device?' prompt is repeated to allow you to enter a type of EPROM. The Autoprommer will handle 27 series EPROMs, ranging from 2k to 8k. Although not yet generally available, even 16k monsters (27128s) are catered for.

If a program is too large for one EPROM, all is not lost, as the Autoprommer provides two sockets the program can be split between two devices (of the same type). For example, using 2764 (8k) EPROMs, a program of up to 16k could be stored, and as 27128 (16k) EPROMs become more readily available, 32k. At present, however, I would advise BBC owners to opt for the 2764 device. Not only are they compatible with the Beeb's sideways ROM sockets, but they can be had for around a fiver, which, for 8k, is good value.

'Robust hardware and accessible software make this an attractive proposition'

Having entered your chosen EPROM, the Prommer routine allows one of four functions to be selected – Clear, Verify, Read or Blow. The first checks the EPROM is blank and ready for programming. Read copies the contents into RAM (useful for transferring the contents of one EPROM to another). Verify checks the contents of an EPROM against the data used to program it. Lastly, Blow performs the Clear function, followed by programming (or blowing) of the EPROM from data in RAM, and, to finish, carries out a verify.

Providing the EPROM is blank, selecting Blow will copy a program into EPROM at a rate of roughly one kilobyte per minute. A repeat option subsequently allows multiple EPROMS to be copied in succession from the same data.

At this point, the chosen program is permanently stored in EPROM. But how do you get it to automatically load and run on switch-on? To do this, a special 'boot' EPROM is required, which is not supplied with the Autoprommer, but needs to be created by the user. At first, this struck me as a rather mean omission. However, the necessary boot, or auto-run routines are supplied on cassette, and the manual provides step-by-step instructions for creating the boot EPROM. This does, at least, serve as a useful introduction to using the device.

Once the boot EPROM has been blown, and inserted on board, the four boot selection switches on the Autoprommer are configured depending on the EPROM, operating system, and whether the program is in Basic or machine code. You can now automatically download and run your selected program on power-up or by pressing break. 'Dummy' switch settings are

provided, so the auto-run facility can be disabled.

I implied earlier that the Autoprommer could be used to program EPROMS for use in the Beeb's sideways ROM sockets. Whilst this is true, two important assumptions are made. First, you must have the 1.0, or later operating system. Second, you will need some understanding of the way the operating system switches between ROMs. On the other hand, no such knowledge is required to exploit the auto-run.

My major criticism is that the error-trapping is virtually non-existent. For example, enter '273299' as an EPROM type, and the program accepts it. More seriously, an invalid hex character when typing in a buffer address will go unnoticed, and the program will happily fill an EPROM with garbage.

In fairness, the cassette supplied does contain the full assembler source code for the programming software, which is also listed in the

'My major criticism is that the error-trapping is virtually non existent'

manual. Evidently, the manufacturers have tried to simplify the task of modifying (or correcting!) the package.

One feature I found lacking was the ability to program selected areas of an EPROM, at separate times. With the current software, an EPROM is always programmed 'at one sitting', from the start of its memory. However, it should not be too difficult to make such modifications.

I also would have appreciated LIF sockets on the Autoprommer board itself because changing EPROMs could be a delicate task. The auto-run feature is so attractive, that I can imagine users building up a small library of programs to plug into the Autoprommer.

At £120 plus VAT, the Autoprommer may seem costly, which is a pity, since the auto-run facility, and EPROMs in general, merit a wider audience. Nonetheless, the robust hardware, and easily accessible software (warts and all!), could make the Autoprommer an attractive proposition in industry, education, or any reasonably well-founded club. Its ability to handle a variety of EPROMs, including a couple of future generations, would be a great asset in such environments.

The ATPL Auto Prommer is available from several BBC dealers (see dealer list), or direct from Advanced Technology Products Limited, Station Road, Clowne, Chesterfield S43 4AB.

BOOKS
THE GOOD, THE BAD & THE PAP

Paul McGee takes a dozen off the shelves and examines their educational value

ONE of Dr Rhodes Boyson's tests for a good school is to see if pupils hold their heads at 45 degrees as they listen to teachers. Although this is a definitive advance in measurable behaviourable objectives, it gives little help when assessing pupils' attitudes to microcomputers. And so teachers might like to consider this dozen literary, and other, offerings.

The first book consists of papers from symposia sponsored by the British Educational Research Association in 1980, which aimed to give teachers some idea of the difficulties of introducing micro-electronics. The second book is a collection of papers from CAL 81 in Leeds; the third from a conference at Roehampton in 1979; while the fourth is of papers, on a more limited range of topics, written in 1980. Much of the best material appears in the book by Lewis and Tagg, which also benefits from recorded discussions.

Reading these books is like watching the local repertory company in a series of old favourites. The same people reappear saying different things but still recognisably the same, and unlike repertory companies, there is no reduction for buying the lot. Schools need to know which are worth buying to help keep curriculum and methods up to date, and readers of *Acorn User* – particularly those writing software – will also want to know how relevant the material is to the BBC micro.

Many papers in these volumes describe systems which are more sophisticated than currently used in schools. However, it would be wrong to ignore these contributions because prices of equipment are falling so rapidly that equivalent computer power will be available to British schools in the forseeable future.

Most of the papers in *Microcomputers in Secondary Education* are too short to do justice to their authors or their subjects. Among the better contributions, Rosemary Fraser deals with evaluation techniques but it is still better to invest in a subscription to the ITMA newsletter than to buy this book. Bob Lewis' excellent account of the pedagogical issues in designing software should tempt many to look again at the Chelsea software, particularly now high resolution graphics versions are available (although not for the BBC micro).

- ☐ **Microcomputers in Secondary Education, edited by J.A.M. Howe & P.M. Ross, Kegan Page, £8.95**
- ☐ **Computer Assisted Learning – Scope, Progress and Limits, edited by R. Lewis & D. Tagg, Heinemann Educational, £4.95**
- ☐ **Computer Assisted Learning – CAL 81 Symposium, edited by P.R. Smith, Pergamon, £12**
- ☐ **Computer Assisted Learning in Physics Education, edited by A. Bork, Pergamon, £10.50**
- ☐ **Computer Software for Schools by Payne, Hutchison and P. Ayre, Pitman, £11.95**
- ☐ **Microcomputers in the class-room, by Alan Maddison, Hodder and Stoughton, £3.95**
- ☐ **An Introduction to Micro-computers in Teaching, by A. Nash & D. Ball, Hutchinson, £6.50**
- ☐ **Microcomputers in Science Teaching, R.A. Sparkes, Hutchinson £7.95**
- ☐ **Elementary BASIC, by H. Ledgard & A. Singer, Collins, £7.95 hardback, Fontana, £4.95 paper**
- ☐ **30 Hour BASIC – School Edition, by C. Prigmore, Longman, £3.95**
- ☐ **Structured Programming with Basic, by R.Atherton, Heinemann Educational, £12.50 hardback, £6.50 paper**
- ☐ **Introduction to Micro-computers, by C.M. Gilmore, McGraw-Hill, £11.50**

After the Cockcroft report, heads of maths departments might be interested in the two articles on Logo, now available for the BBC micro, and the one on using programming to help teach algebra.

In case the idea has grown that micros are for teaching maths, Sharples gives a stimulating discussion of their use in language development. He attacks many current teaching packages as inferior teacher substitutes equipped with outmoded and incomplete principles of education. He wonders if any headteacher would welcome a teacher with a didactic and patronising style, confined to one style of learning and unable to meet the demands of pupils. At least one ex-headteacher would say it all depended on the angle of the pupils' heads.

Many authors tend to give straightforward accounts of CAL projects, but the more interesting articles deal with some problems of designing and implementing CAL packages. Much of this good work is in Lewis and Tagg.

In this book Jensen points out that it is important to distinguish between the computer as a medium and the way it is used since CAL often gets a bad name from particular bad examples. This distinction is more important than with other media such as books or films, for which there are no comparable terms such as book based learning or film assisted teaching. Bork, in the best paper in all these books, discusses myths about computer usage and clearly sees that computers will not be used widely in expositional class teaching. However, as Moonen shows, sensible use of computers in teaching statistics produces improved attainment and insight.

CAL 81 contains a wide range of papers with notable contributions from the British contingent

including well presented projects from the Open University. Edinburgh's variations on a theme of Logo are disappointing to those whose appetites have been whetted by Papert's book. The ITMA contribution shows that their forthcoming CET publications will be required reading for all CAL designers.

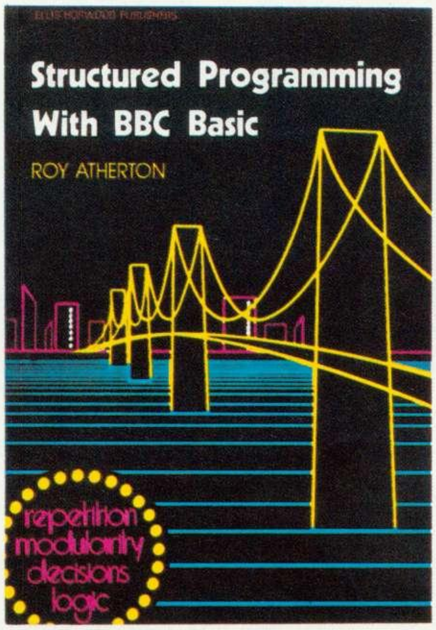
The Howe and Ross book can be only moderately recommended, but the Lewis and Tagg volume should be in every staffroom. The *CAL 81 Symposium* is quite good, but the price is excessive. *CAL in Physics Education* is worth reading to see how good Plato graphics are, and to see Peter's grid for evaluating software, but it is too expensive to be recommended for teacher or departmental use.

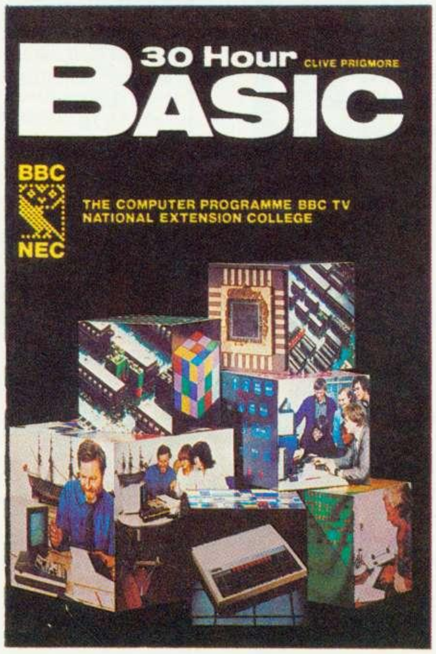
Computer Software for Schools was good when it first appeared in 1980 but it is now badly dated. All of the programs will run on the BBC micro with minor amendments, although experienced users will sorely miss graphics, sound and colour.

The book is a good attempt to teach elementary Basic programming while developing an understanding and appreciation of the range of applications of computers to education. As a source book of examples in computer aided learning it is sadly deficient, but it could be the basis of valuable in-service work because many of the examples are academically unsophisticated. Its reliance on Basic to perform information retrieval was outdated in 1980 and, although it might get support from the work Frank Gregory is doing on the Isle of Wight, no one can now doubt the fundamental importance of information retrieval and database packages.

In *Microcomputers in the Classroom,* Alan Maddison attempts to provide a brief overview. The book is a useful antidote to much over-optimistic advertising material, but sometimes the caution is overdone. A casual reader could be forgiven for concluding that television screens are a poor medium for text, that pictures are bad at conveying information, and that colour can reduce the effectiveness of a program. It is nevertheless strongly recommended for the staff library.

One weakness of Alan Maddison's book is the lack of examples of





good software. By comparison *An Introduction to Microcomputers in Teaching* contains 20 programs for the Research Machines 380Z.

The book contains an invaluable 10 pages of discussion about the use of computers in *learning*, rather than the more usual emphasis on *teaching,* and should be read by anyone thinking of writing or specifying computer programs for use by children. However, unless the reader has ready access to a 380Z the value of the book is much reduced.

Microcomputers in Science Teaching is of little value to a BBC user. The first three pages contain the minimal educational discussion and the rest of the book has a great deal about programming the Pet.

Users who are fortunate enough to have the advanced facilities of BBC Basic and its excellent graphics are unlikely to want to use a Basic programming book which hardly seems to have left the teletype era.

Elementary BASIC, subtitled 'Teach yourself BASIC by solving the mysteries of Sherlock Holmes' is based on minimal ANSI Basic. It attempts to teach the language by developing logical problem solving in the way Sherlock Holmes would have done on Babage's Analytical Engine, if it had used Basic. Much of the approach is designed for a structured language and the program listings often seem uncomfortable after the algorithms have been well developed. BBC micro users might well find the Pascal version better if they want to use structured programming techniques.

The School Edition of 30 Hour BASIC seems to have been written at least a decade before the BBC micro. The features which make BBC Basic so valuable are totally ignored and the program test is written in capital letters.

The general level of the book is that of a top junior but the maths section is 'O' level and beyond. Overall, this book is mind rotting pap for indisciplined computer junkies and not even the low price can commend it.

By contrast, *Structured Programming with BBC BASIC* gives a comprehensive and lucid account of problem solving techniques. It is good to see Roy Atherton, who has determinedly fought the cause of structured programming for many years, applying his ideas to such a popular micro. The reader still needs to have the BBC *User Guide* to hand as some of the explanations of BBC Basic are inadequate, but this book is strongly recommended to any serious programmer, teacher or pupil. It is not, however, a book for teaching pupils of all abilities.

Those who want to look inside the micro and gain some general understanding of machine architecture and assembly level programming will find the 310 A4 pages of *Introduction to Microprocessors* good value. The text is not specific to the BBC or even the 6502, and will not therefore be much use for detailed work with the BBC micro.

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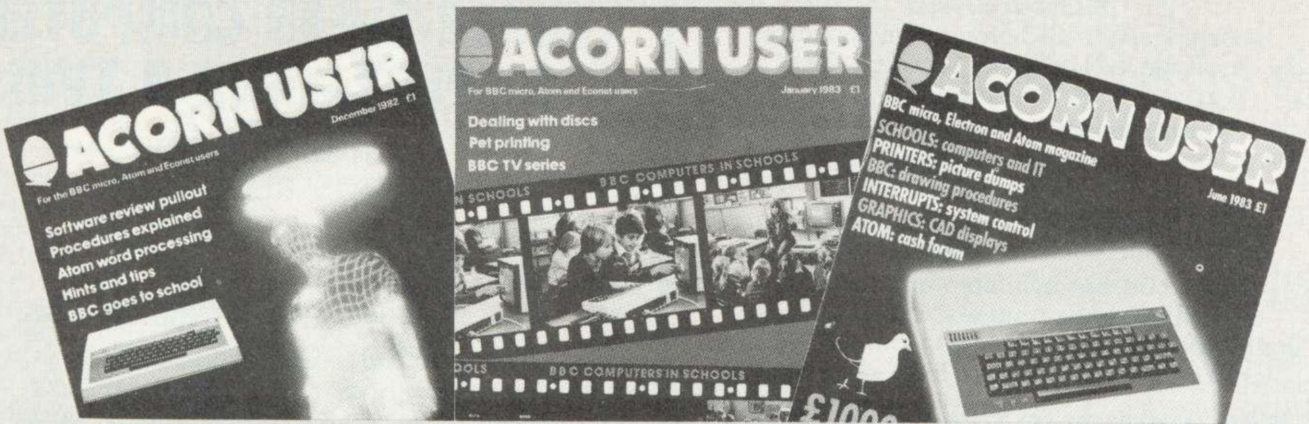
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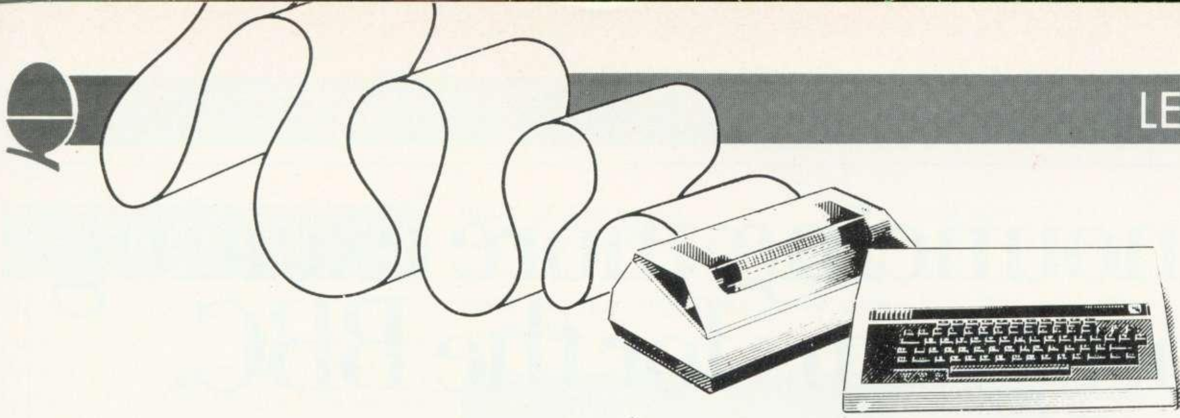
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MINI TO MICRO

Sir, First, may I join the many in thanking you for the excellence of Acorn User? I subscribed from its inception and it provided a stimulating read while waiting for my B with disc/Econet ordered in November 1981. However, the magazine has really proved its worth since the aforesaid machine was delivered this year.

I claim no record for patience, accumulated correspondence or telephone bills, but I may be the only user group of one member, for Acorn do not plan on entering the small Swiss market in the foreseeable future. (A pity, because money is available and Switzerland, in many respects is in the Middle Ages with regards to computing. A product like the Beeb could be in the vanguard of a breakthrough). They have recently opened an office a couple of hundred miles away in Germany, but apart from a small squeak in December, I've not been able to raise any signs of life.

My interest in the Beeb, going back to the very first information of Autumn 1981, rests in the search for a versatile, high-performance micro as the basic laboratory machine for data-acquisition and processing in a research group of about 750 employees.

With its national character and the ensuing software and peripheral support, the Beeb seemed then, and now, ready-made for this. The manner in which it has been, and is being, taken up by institutes of higher education in the UK seems to support this opinion, which was formed in spite of the enormous difficulties encountered by the geographical and mental distance of the band of four (BL/Vector/Acorn/BBC) from customer service/information. It is in this latter aspect that your magazine is such a boon.

Slowly coming to my second reason for writing, an important factor in my interest is the linking of a Beeb system, either alone or Econetted, to a HP1000 mini. Are you planning any detailed articles about this in the near future? I am really very naive about this, and so will have to start at a very low level. I at least recognise it is not a simple matter of joining B to X with a hair-pin. If you are not planning anything immediately, do you know of anyone who could lend a guiding hand? I would appreciate your recommendations.

Again, thank you for AU.

T.G. White
Wander Research Institute
Switzerland

Linking the Beeb to a HP1000 is not, unfortunately, on our agenda at the moment. However, if any readers can help, we will pass letters on to Mr White.

IRATE IN THE ALPS

Sir, I am writing to you as a last resort in my quest to purchase a BBC model B computer.

I want to order a fully expanded model B complete with disk, Econet, speech synthesis and cartridge ROM pack interfaces (if available). I have written to six companies advertising in your magazine (three of which advertise that they export), since January, but only one bothered to reply, and they were unable to export hardware.

The normal terms for exporting from the UK is the UK price less VAT but plus postage and insurance at cost. I pay the Swiss VAT when it is imported into this country.

I have already enquired from Vector Marketing who will not supply the BBC computer VAT free. They state VAT is used to pay for the extra postage. For a model A this is about £35 and for a fully expanded model B over £60 which seems excessive, when an Atari 400 was exported VAT free and £10 charged for postage.

When the BBC computer was announced there was a lot of interest shown by my colleagues, who like me are system programmers working for Brown Boveri Cie (the BBC of Switzerland). But trying to get hold of, first information, and now a compuer, has been very frustrating, as very few UK companies, including the BBC, bother to reply to either my letters or my other colleagues' letters.

If other people in Europe are receiving the same negative attitude as I have received, I cannot see how UK companies expect to export, which is a pity as they do produce some very good products (if only you get hold of them).

R.A.Norton
Switzerland

All is not well in Switzerland, judging from these letters, although at least Mr White is not alone.

Now, what about it Vector, Acorn and the rest of the UK? When are we going to see a solution to this simple problem?

Incidentally, the Swiss BBC is the reason for having to rename the machine the 'British Broadcasting Corporation Microcomputer' overseas.

NEW COMMAND?

Sir, Does anybody know what the operating system command *DEBUG does. It is recognised by the command line interpreter of OS 0.10, but is undocumented. Another recognised command is *NOTAPE, but this is not very useful as it simply turns the cassette filing system off and gives a 'No filing system' error when any attempt is made to save a file.

I. Okey
Cambridge

***DEBUG doesn't do anything at all. It's a remnant from very early versions of the operating system used only by Acorn and it has no effect in any machine issued to the public.**

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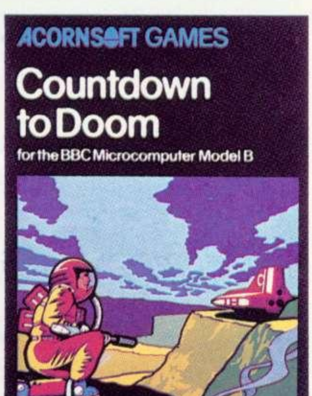
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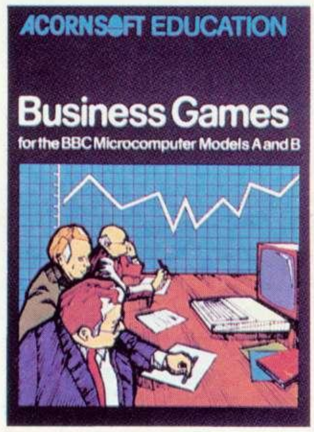
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Alternatively, you can buy the cassettes directly by sending off the order form below to: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.

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ACORNSOFT

DISC PUZZLE

Sir, Several members of our club are puzzled by the following error message: 'Can't extend at line XX'. We suppose it is related to the DFS but we have not been able to find any explanation in the BBC micro or Teac drive manuals.

It happened to us when trying to save a program in ASCII code on top of a previous similar program under the same name or when writing fresh information in a file. There was plenty of room available in the diskettes in both cases.

If that error message is printed by the computer, it seems there is nothing to be done but to delete the previous program or file, in which case the new ones are accepted without further difficulties. Can anyone out there give us an explanation? Many thanks in advance.

I. Beng
Tenerife

The message means there isn't room for the whole file as one contiguous block of disc space.

Use *COMPACT to free all disc space into one block and then re-open the file (using the space now available).

SLOW ROMS

Sir, Is the 1.2 ROM slower than the EPROMs? The following short program when executed on a model A/B BBC computer fitted with the 0.1 ROM or 1.0 ROM appears to take on average 10.6 seconds, but on computers fitted with EPROMs the time taken is 13.6 seconds.

```
10 TIME=0
20 FOR X=0 TO 1000
30 PRINT X
40 NEXT X
50 PRINT TIME/100
```

Having just been lucky enough to have the 1.2 ROM fitted I discovered that the time on the above program was now increased to 16.6 seconds.

On querying this with the dealer concerned I was told this was normal as the 1.2 ROM was slower because it had more facilities. I also queried the position of jumper S19 which was still situated to the west or left, and was told this was correct. I then rang Acorn who told me that this jumper should in fact lie to the east.

On respositioning this jumper and running the above program the time taken was now 10.6 seconds. Another dealer was asked the same question on the position of S19 and again said it was correct for it to lie to the west.

S19 lies immediately above IC23, and on all circuit boards fitted with a ROM chip it does lie to the east or right side.

H.A. Leonard
Berks

The links should be east (S19) and north (S18). Acorn will supply a complete fitting sheet for the MOS upgrade if you send them a SAE. On the links question the full list of changes are: S18 – north; S19 – east; S20 – north; S21 – (two of) east/west; S22 – north; S32 – west; S33 – west. North is the edge of the board at the back of the case and south is the edge nearest the keyboard. East and west follow on.

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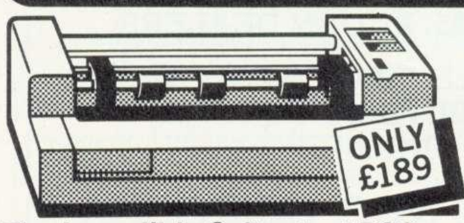
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RADAR ANSWER

Sir, I note with interest Chris Allard's letter about radar pollution. I live nearly under the approach path to RAF Northolt and when I first got my BBC B I was very disappointed with the picture quality. I improved it by using normal TV, UHF co-ax cable instead of the one supplied, but found that the main problem was patterns of black dashes appearing all over the screen. This reminded me of problems encountered even closer to Northolt, with a Video recorder.

I found the frequency of the Beeb could be changed by using the ferrite screw in the RF unit (the little tin box on the right of the Beeb) in the rear right-hand corner of the machine. However, 'turning off' channel 36 produces other problems as the Beeb seems to act as a good aerial and I find the whole of that frequency range is full of faint, but still annoying transmissions. I have at last managed to find a 'Hole' free from radar (if that is the cause of the black lines) and faint TV stations, at around '45' on the dial.

Unfortunately, I am still plagued by random break-ups of the whole picture.

I.S. Mulelly
Middlesex

DATE SHEETS

Sir, Last December I bought a BBC model B, it developed a fault in January. At switch-on flickering, vertical lines show and when a games program is run 'sound on vision' symptoms are present. I obtained a replacement from Vector Marketing but after one week it developed the same symptoms. Is this a common fault? I have tried several televisions.

Is it possible to obtain a service Manual for the BBC micro?

R. Pyrah
Cumbria

This problem is not common. We've never seen it and so we've passed your letter on to Acorn. Their engineers are looking into it.

On your second point, Acorn only distribute service manuals to dealers and educational service centres.

Acorn do produce a 1MHz bus Application Note for £2.50 (no VAT) strictly cash with order. This covers interfacing the Acorn Eurocard range and user-designed peripherals to the 1MHz extension bus.

They also have data sheets on all the integrated circuits they use, priced at £1 (no VAT) strictly cash with order. These include: 6502; 6809; 6522; 6845; 7002; 6100; 5220; 76489; SAA5050; 6854; 8271; 74 series; 6847; 2114 and 4816.

However, please note that no data is available on Acorn ULAs.

BBC BLAMED

Sir, I read the correspondence relating to radar interference with interest as it is similar to my own experience with a television transmitter.

After a considerable wait for a BBC cassette recorder I found I could not load or save programs. It only gave statements such as Data? Block? This was strange since I had borrowed a neighbour's recorder which had worked perfectly. After much trial and error I took the recorder to my neighbour's home where it worked perfectly!

We then tried it in another room in my own house where again it worked perfectly.

We are within half a mile of the BBC transmitter at Crystal Palace in London and this was the causeof the problem.

My solution has been to encase the recorder in a metal box to protect it from the interference. Although this is inconvenient it is a relief to be able to use the recorder and computer.

Raymond Cousins
London SE19

LINE ERROR

Sir, Do you have any information on the basic keyword 'line' available on the BBC micro? On first receiving my computer only the provisional manual was supplied. To check out what commands were available I looked through the minimum abbreviations list, and line appeared. No description was given. When the *User Guide* arrived there was still no description. When typed into the computer the error message 'Syntax error' is given, showing the interpreter accepts it as a valid Basic word. Is it possible that it's a graphics command?

T. Dinham-Peren
Surrey

No, Line isn't a graphics command! It is an optional extension to the Input statement and (as explained on page 278 of the User Guide) it is used to accept every charcter as valid during the input – usually leading spaces would be removed and the input would terminate at a comma.

>>>>>'S

Sir, I own a BBC model B with an 0.1 OS, which had developed what seems to be a serious fault.

About every 30 seconds after switching the machine on and not touching the keys, the computer starts printing >'s on every second line at random intervals. On occasions it will print up random key words in full across the screen. While all this is going on the keyboard is totally inoperable with the exception of the break key. Pressing that will reset the computer but within a few seconds, random >'s appear again.

I don't know if the problem lies in the German electricity supply or if it lies in one of the chips.

S. Griffiths
West Germany

You do indeed have a problem. Your machine either has a RAM fault or a faulty OS. The dealer to contact for help in Germany is Acorn Overseas Ltd Deutschland, Anzinger Strasse 1, D-8000, Munich 80.

CRØ2 = 3TØ7

Sir, None of the articles and correspondence I have seen in the computer press has said anything about the type of cassette tape to use with the BBC micro, other than to suggest reasonably good quality tapes. I have discovered that if one uses chromium dioxide quality tapes rather than the ferric type one gets one hundred per cent success at 1200 baud for both programs and data files.

When my model B had the 0.1 OS I found that using ferric oxide tape even the patch program would not allow me to use 1200 baud, but with CrO_2 I didn't need to patch anyway. Now I have upgraded to the 1.2 the results are just the same, ie ferric oxide is no good for 1200baud, but CrO_2 is perfect. I use a Ferguson 3T07 recorder.

I hope that others will find this tip useful.

A.H. Jones
Berkshire

USER GROUPS

WHO'S WHERE

WHAT'S WHAT

We've been swamped by messages from new groups this month. It would be impossible to give full details of you all, so here's a quick run-down of who's where and what's what. **Sutton Library Computer Club**, contact Jennifer Woeller on 01-661 5031 or David Wilkins on 01-642 3102 (evenings); **BBC Micro User Group,** Wakefield, contact Richard Sterry on Wakefield 255515; **Peterborough Personal Computer Club,** contact Andrew Pike on 0733 44342 (after 5pm); **Beebnet, South Australia,** contact Lindsay Thachuk through the address below; **BBC Micro Club, Tenerife,** contact I. Beng at the address below; **Mid-Cheshire Computer Club**, contact Dave Clare on Winsford 51374; **Kinder Peek Computer Club,** contact John Eary on New Mills 43870; **Iver Computer Society,** contact John Haigh at the address below: **Keighley Computer Club,** contact Colin Price on Keighley 603133; **Wandsworth Computer Club,** contact C. Verrier at the address below; and the **Brighton, Hove & District Computer Club**, contact the secretary at the address below.

Keep them coming!

CLUB CONTACTS

- Rupert Steele
Amateur Computer Club
St John's College
Oxford OX1 3JP

- **Beebug**
374 Wandsworth Road
London SW8 4TE

- J. Smith, Secretary
Brighton, Hove & District Computer Club
30 Leicester Villas
Hove
E. Sussex BN3 5SQ

- Dr Leo McLaughlin
North London BBC Micro Users Group
Dept. of Chemistry
Westfield College
University of London
Kidderpore Avenue
London NW3 7ST
Tel: 01-435 0109

- **West Midlands Computer Group**
12 Apsley Road
Oldbury
West Midlands B68 OQZ

- Mr J. Price
Bedford House
27-28 ST George's Road
Brighton
Sussex

- Mr P. Beverley
Norwich Area Acorn User Group
Room 12a, Norwich City College
Ipswich Road
Norwich NR2 2LJ

- Keith Mitchell
Edinburgh ZX Computer Club
19 Meadowplace Road
Edinburgh
Tel: 031-334 8483

- Steve White
Atom/BBC User Group
c/o Superior Systems Ltd
178 West Street
Sheffield
Tel: (0742) 755005

- Robin Bradbeer
Association of London Computer Clubs
Polytechnic of North London
Holloway
London N7 8DB

- Nik Kelly
Liverpool BBC & Atom Group
56 Queens Drive
Liverpool L4 6SH
Tel: 051-525 2934

- Andy Purkiss
Namebug
6 Palm Close,
Witham, Essex.
Tel: 0376 515609

- I. Beng
BBC Micro Club
PO Box 1297
Santa Cruz de Tenerife
Tenerife

- Lindsay Thachuk
Beebnet
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South Australia 5062

- Richard Sterry
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- R. Welch
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Norway

- R.V. SOuter
TRS/80 Beeb Users Group
25 Carr Lane
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Tel: 0482 654117

- E.R. Piper
Bognor Computer Group (BUG)
2 Ely Gardens
Aldwick Park
Bognor Regis
Sussex PO21 3RY

- Andrew Pike
Peterborough Personal Computer Club
920 Bourges Boulevard
Peterborough PE1 2AN
Tel: 0733 44342 (after 5pm)

- Dave Clare
Mid-Cheshire Computer Club
'Providence House'
222 Townfields Road
Winsford
Cheshire CW7 4AX
Tel: Winsford 51374

- **Liverpool BBC Microgroup**
c/o Fred Shaw
14 Albany Avenue
Eccleston Park
Prescot
Merseyside L34 2QW

- John Harris
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Bottisham
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- Peter Smith
Fareham and Portchester Amateur Computer Club
23 Sandy Close
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- Paul Barbour
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10 Dawley Ride
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Slouth
Berks. SL3 OQH
Tel: 02812 3064

- Brian Pain
Colour Micro Users Group
40a High Street
Stony Stratford
Milton Keynes
Tel: (0908) 564271

- Mr. D. Coulter
Preston BBC User Group
8 Briar Grove
Ingol
Preston PR2 3UR

- **Acorn Users Group of Sweden**
c/o Janne Soderberg
Frihetsvagen 32
S-175 33 Jarfalla
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Bangor & District Micro Users Group (BADMUG)
Fodol Farm
Hafod Lane
Bangor
Gwynedd LL57 4BU

- Peter Wilson
Universal Micro Club
26 North Cape Walk
Corby
Northants NN18 9DQ
Tel: Great Oakley 742622

- John Haigh
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141 Leas Drive
Iver
Bucks SL0 9RP

- John Eary
Kinder Peek Computer Club
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New Mills
Tel: New Mills 43870

- C. Verrier
Wandsworth Computer Club
Earlsfield Library
Magdalen Road
London SW18

- Mr J. Craig
National BBC User Group
40 Mount Pleasant Avenue
Wells
Somerset BA5 2JQ

- Mr R. Luff
Kingbee
54 Arlington Close
Kingswinford
West Midlands

- **Computer Club**
Caterham Leisure Centre
Godstone Road
Caterham
Surrey CR3 6RE
Tel: Caterham 48304/43316

- Ted Ryan
Eastwood Town Microcomputer Club
15 Queens Square
Eastwood
Nottingham NG16 3BJ

- Mr T.A. Kayani
SOBAT Computer Club (East London)
B25 Berridge House
Hillfield Road
West Hampstead
London NW6

- Mr M.G. Forster
Potbug BBC Users Group
8 St George's Avenue
High Lane
Tunstall
Stoke-on-Trent
Tel: 818499

- **Muse** (for teachers)
Freepost
Bromsgrove
Worcs B62 7BR

- Mr B. Carroll
The Cottage,
42 Manor Road,
Aldershot GU11 3DG

- Steve McLeod
BBC Users Group of Canberra
5 Hatfield Street
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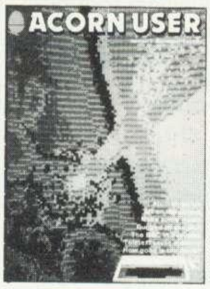
BACK ISSUES



July/August The first issue. Articles on drawing techniques, the BBC Computer Programme, machine code graphics, questions and answers, hints and tips, sound, interfacing, scientific instruments, dumb terminals for 0.1 machines, disc drives, Econet in schools.



November Teletext, second BBC TV series, machine code series 1, programming forum, Trek III, speeding up graphics, Bomber game listing, 7-tone Epson graphics dump, Atom graphics manipulation, dumb terminal for 0.1 machine, firework graphics, editing tips.



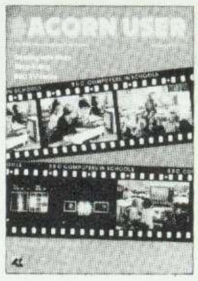
September Ceefax telesoftware, Beeb in business, mailing list, simple files, 30-Hour Basic course, art on a micro, music, BBC micro as a keyboard, extra Atom commands, BBC Basic board, ULA design, teletext graphics, machine code graphics, analogue input, schools training, 0.1 cassette bug patch.



December BBC TV in schools, machine code 2 – registers, programming forum, program generators, carols, hints and tips, Logo and turtle graphics in schools, introduction to procedures, software review, Atom word processing, toolbox review, 16-colour graphics on model A, sorting, sound envelope design.



October Electron details, BBC TV series – confessions, two Epson graphics dumps, Seikosha GP100 dump, Worldwide networking for BBC micro, garbage handling, voice ROMs, sound pitch envelope, moving graphics, ZX printer for Atom, RGB colour separations for Atom, biofeedback, book reviews.



January MEP school launch, *FX commands for sound, second BBC TV series, machine code 3 – two pass assembly, disc drives for the Beeb, programming forum, program protection, micros in schools – new series, Commodore Pet printer used with Beeb, BBC programs written on an Atom, extra Atom memory.

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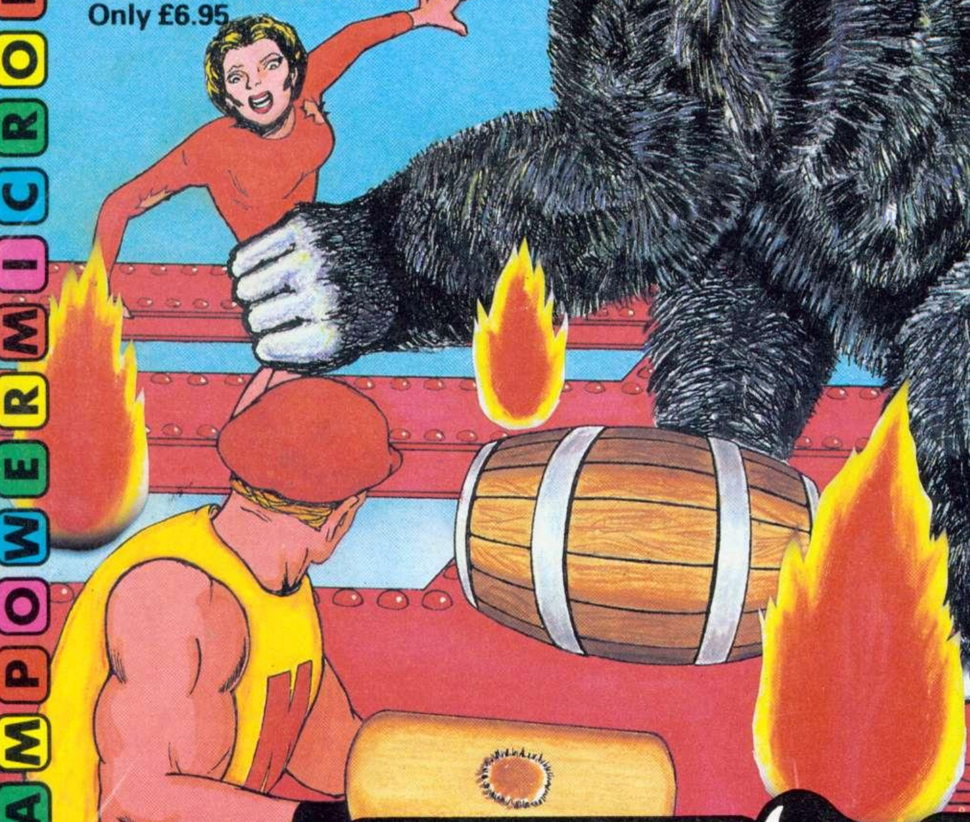
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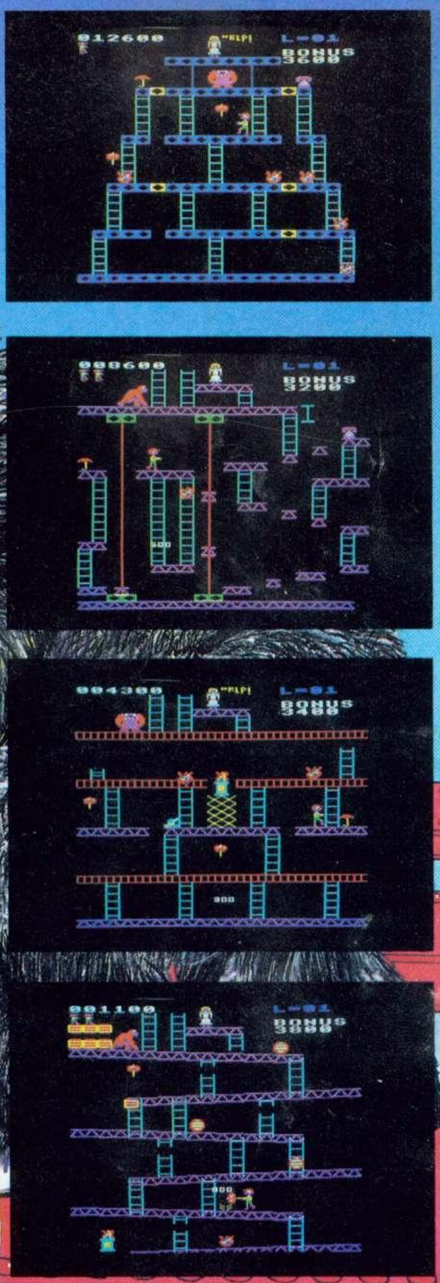
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